D301.81:
30/5

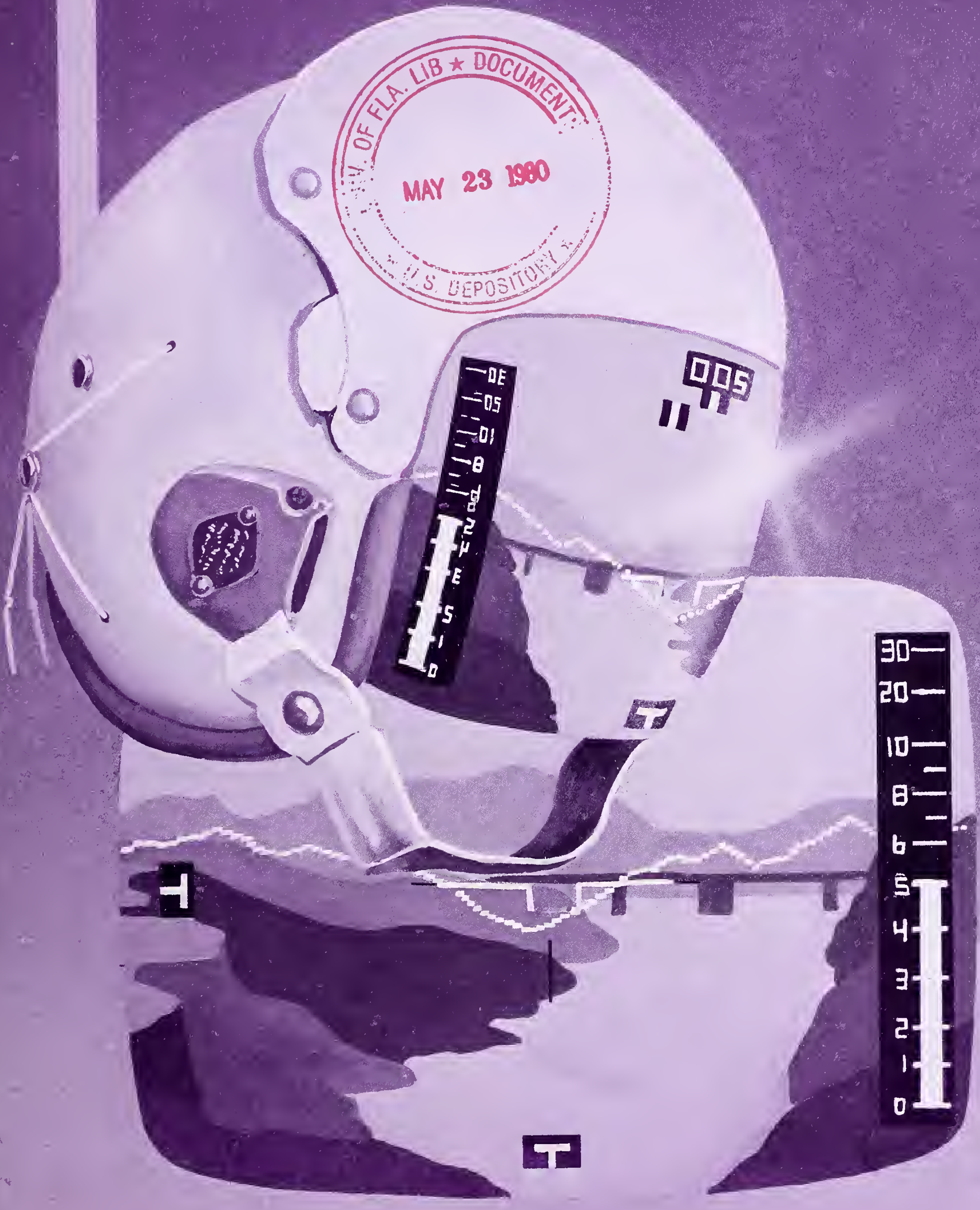
Combat Crew

strategic air command

★★★★

MAY, 1980

UNIV. OF FLA. LIB ★ DOCUMENTS ★ U.S. DEPOSITORY
MAY 23 1980



Combat Crew

Magazine of the Strategic Air Command - 30th Year of Publication

GEN. RICHARD H. ELLIS
COMMANDER IN CHIEF, SAC

BRIG. GEN. RICHARD A. BURPEE
Inspector General

COL. RICHARD A. PATRICK
Director of Safety

STAFF

MAJ. STEPHEN J. MILLER
Editor
G. FRANCIS FARRELL
Associate Editor
SSgt. RICHARD L. WALDROOP
Art Editor
MARY JANE ABBOUD
Editorial Assistant

FLARE

IN THIS ISSUE

Let's Talk TA/EVS 4
When Lightning Strikes 8
BIG Instrument 14
Getting to the Fix on Time 16
CFIC Corner 18
R&D Corner 22

ON OUR COVER
EVS aided TA flying in the B-52 G/H is an important aspect of the mission. For some thoughts on the techniques of TA/EVS flying see page 4.

SACRP 127-1 **VOL. XXX NO. 5** **MAY 1980**

COMBAT CREW is an internal publication of the Strategic Air Command with the sole purpose of promoting safety. The contents of this magazine are informative and not to be considered as directive in nature. Facts, testimony and conclusions of all mishaps printed herein may not be construed as incrimination under Article 31 of the Uniform Code of Military Justice. All names, dates and places used in conjunction with mishap stories are fictitious. Written permission must be obtained from Headquarters, Strategic Air Command, before any material may be reprinted by other than U.S. Air Force organizations. Use of funds for printing the publication has been approved by Hq. USAF. Distribution FX, controlled by IGFC. SAC units submit distribution requests through local PDO. Reader to copy ratio 9:1.

Subscriptions are available from: The Superintendent of Documents, Government Printing Office, Washington, D.C. 20402. Price: $14.00 per year domestic; $17.50 if mailed to a foreign country; or $1.20 single copy. Authority to publish this periodical automatically expires on 7 April 1982, unless its continuance is authorized by the approving authority prior to that date. Contributions are encouraged as well as comments and criticisms. Direct correspondence with the Editor is authorized. Address correspondence to Editor, COMBAT CREW, Hq. SAC IGFC, Offutt AFB, Ne. 68113.

SAC READINESS

The

Brig Gen Richard A. Burpee
Inspector General, SAC

The Inspector General charter is to check on the health and pulse of the command as it translates to readiness. In addition to Global Shield, Red Flag, Blue Flag, and various other exercises, the Operational *Readiness* Inspection (ORI) is both a test and an opportunity to display unit capability to respond to wartime taskings. To make the ORI as realistic as possible and test the readiness of every person assigned, the IG now applies the same damage expectancy (DE) formula the war planners have used for years.

This formula is new in the ORI evaluation process and requires all of us to adjust our thinking from CEA's and CEP's to the real world of damage expectancy. Damage expectancy is the final results of surviving a launch, weapon systems reliability, target penetrability, weapons accuracy, yield, and target hardness. Therefore, every phase is critical to the success of a mission.

The IG has been using the DE formula for only a year and it is proving a most effective measure of combat readiness. The formula measures total performance beginning with the battle staff and permeating throughout the unit. It brings into focus all areas throughout a unit

DE Formula

DAMAGE EXPECTANCY (DE)

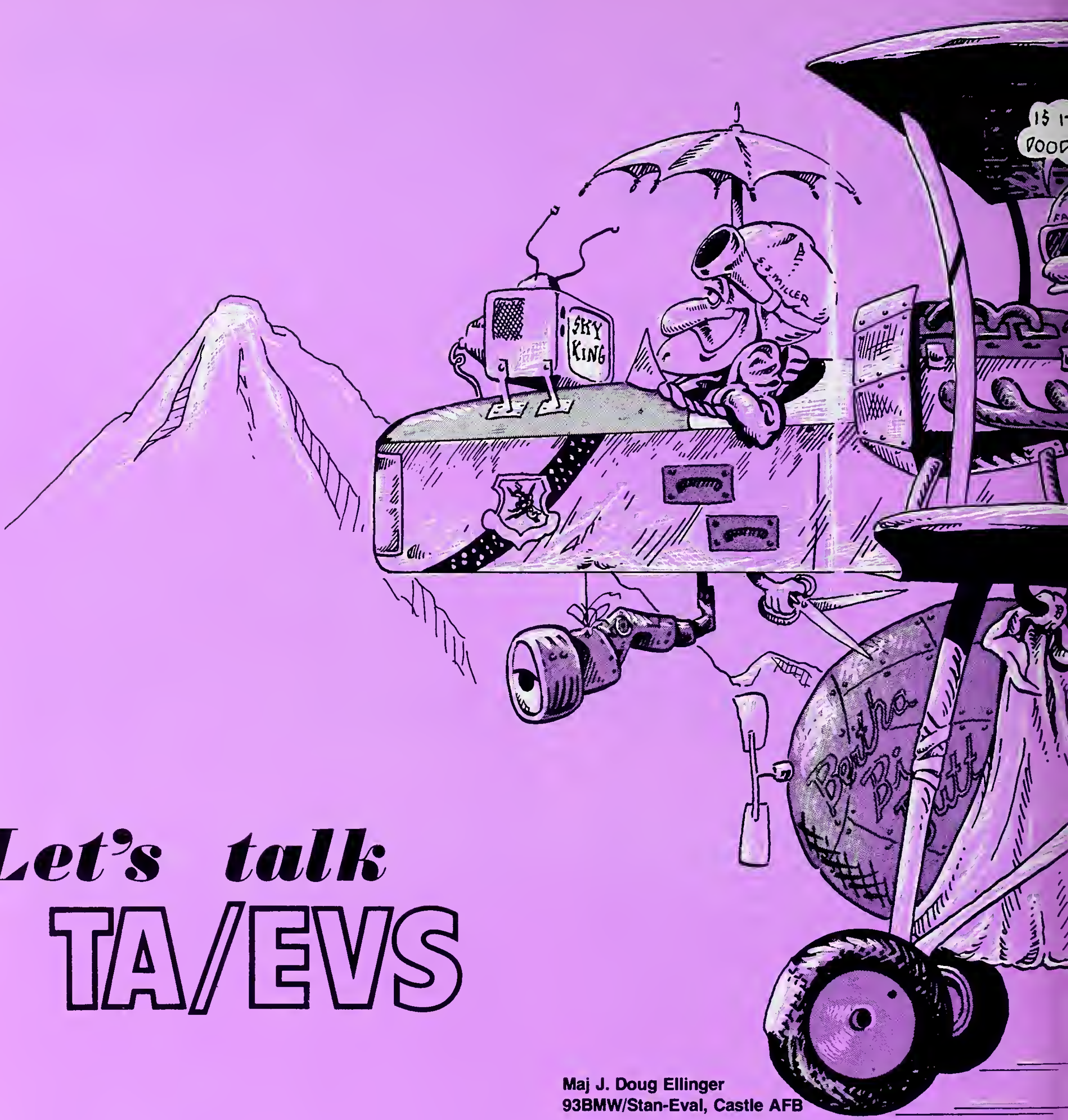
PLS - Pre-launch Survival
X
WSR - Weapon System Reliability
X
PTP - Probability to Penetrate
X
PD - Probability of Damage
=
DE - Damage Expectancy

that not only performs but supports the mission. There is not a single functional discipline within a unit that can afford to not be a team player. For example, during a recent ORI a fast ride vehicle failed enroute while responding to a klaxon. Fortunately, a security police vehicle responded immediately, picked up the crew, and delivered them to their aircraft. The crew met their prelaunch survivability timing with only 10 seconds to spare. The transportation squadron could have caused the loss of PLS, but the security police had the presence of mind to appreciate the critical response time and delivered the crew to the aircraft.

Combat crews are measured in four vital aspects of the formula. First is prelaunch survivability. PLS for both bombers and tankers is as critical in an ORI as in an EWO condition. Knowing the rules as prescribed in SACR 50-5, as they apply to the EWO launch conditions, is vital. Second is rendezvous and refueling. The third crew measure is how well you perform in penetrating a simulated combat environment by using ECM, FCS, TA, and low level navigation. Deviations in any of these areas will degrade your probability to penetrate. Finally, how well you put the bombs and SRAMs on the target determines the probability of damage. While low CEP's are essential for accuracy, remember probability of damage is also a function of target hardness and weapon yield. This is a slight change from past ORIs when only bombing reliability was measured against a set CEP. Therefore, getting a *low* CEP is critical on every target.

The results of the DE formula, as measured by the IG team visits, highlight several areas. Battle staff decisions must square with EWO requirements in the unit WSP 440 plans. Aircraft systems reliability and quality maintenance are being surfaced by individual systems such as BNS, FCS, ECM, TA, etc. Crew performance across the full spectrum of flight from takeoff to bombs on the target is also individually evaluated and specific weaknesses are identified. Finally, it measures total unit commitment in demonstrating a unit's combat readiness.

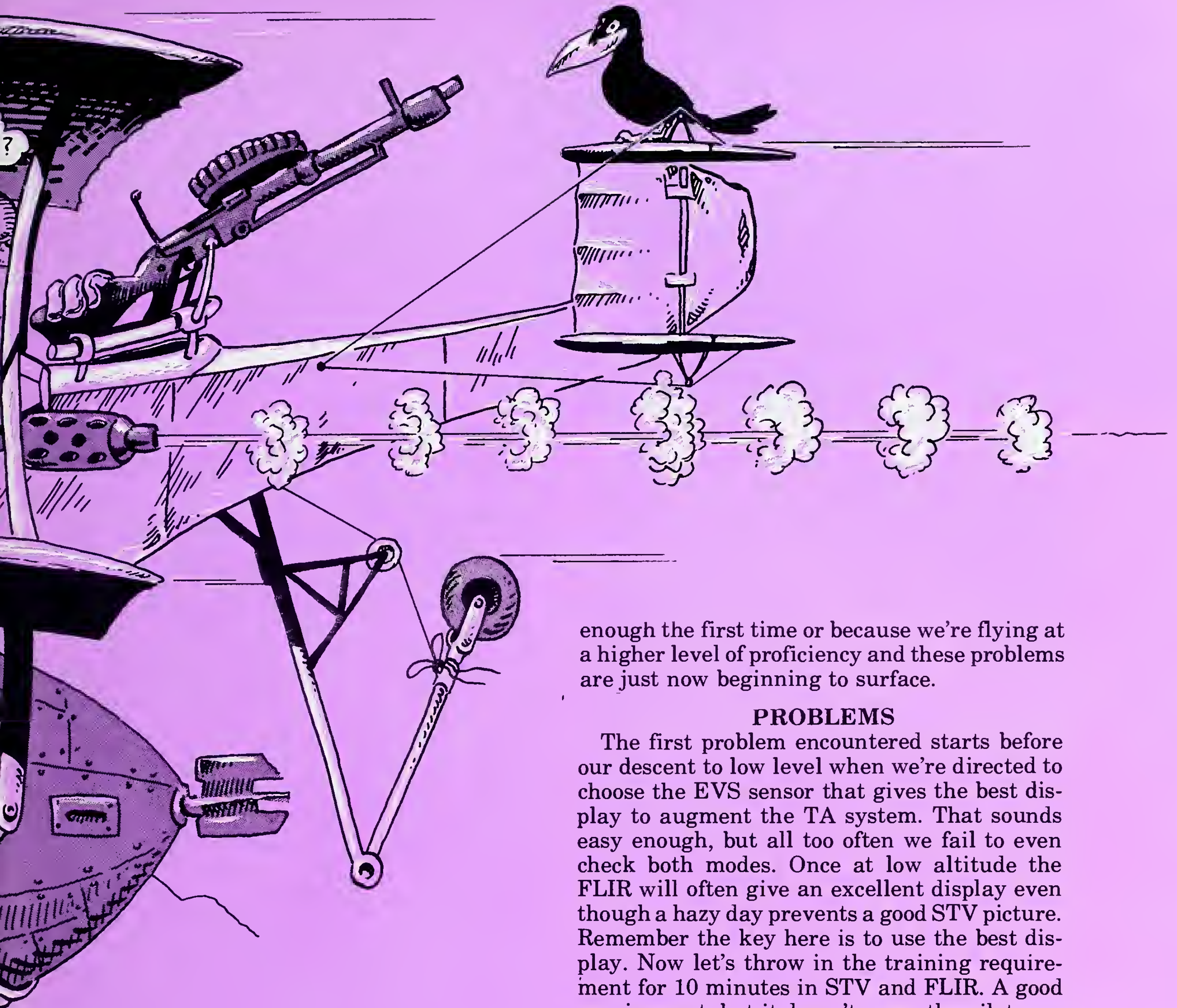
I encourage you to think about your important role in successfully demonstrating SAC's combat readiness with the DE formula. ★



Let's talk TA/EVS

Maj J. Doug Ellinger
93BMW/Stan-Eval, Castle AFB

Since the arrival of the terrain avoidance / electro - optical viewing system (TA/EVS) videotape and the authorization to fly night mountainous TA, we at the Castle B-52 CCTS have noticed a general increase in TA knowledge and interest among pilots and navigators returning for upgrade training. From a vantage point in the Stan/Eval Division, the proficiency and aggressiveness crews demonstrate during TA has shown a remarkable improvement over the last several months. More recently, the new discussion of EVS-only



TA in the flight manual has opened a whole new area of operations for discussion. The emphasis should be on combined TA/EVS flight with TA as the primary reference. All this new-found interest, experience and awareness has not come, though, without a fair share of problems and rough spots. We're doing well, but we can still improve our capability.

There are some areas where we can do better in our TA/EVS operations. Let's look first at some problems that have been cropping up recently, either because we didn't learn well enough the first time or because we're flying at a higher level of proficiency and these problems are just now beginning to surface.

PROBLEMS

The first problem encountered starts before our descent to low level when we're directed to choose the EVS sensor that gives the best display to augment the TA system. That sounds easy enough, but all too often we fail to even check both modes. Once at low altitude the FLIR will often give an excellent display even though a hazy day prevents a good STV picture. Remember the key here is to use the best display. Now let's throw in the training requirement for 10 minutes in STV and FLIR. A good requirement, but it doesn't mean the pilot controls one sensor, the copilot the other; then switch half-way through the route. This deprives the Nav team of a sensor, should they need to use one, so plan accordingly. Add to this the checkride situation. It's not reasonable to expect a crew to watch 10 minutes of possibly mediocre FLIR display when the STV offers a better picture and the name of the game is high performance threat penetration.

As we integrate TA and EVS information to enhance our low level capability the problem of "what display are you watching" crops up. It's not a problem to the pilot flying the aircraft, but to others it can turn into a guessing game that could cause misunderstanding and mask an otherwise superb performance. The solution is more effective crew coordination and the added benefit of enhancing training and flight safety. Many pilots have found that verbalizing their actions is helpful. If the pilot announces every time a transition is made from TA to EVS and vice-versa, there would be no question of the display used for primary terrain clearance information, and the pilot not flying could verify the validity of the pilot's choice of displays.

There seems to be some misunderstanding of the correct way to make final adjustments to the clearance plane setting. Merely flying the radar altimeter to the desired absolute altitude and making the trace coincident is contrary to good safety practices, valid only over absolutely flat terrain, and may in fact lead you to "adjust out" an actual high terrain indication. Perhaps the best information for corrections is a series of crossovers after having flown the trace religiously over each one.

As crews begin to fly more aggressive TA/EVS they are making frequent use of airbrakes for rapid descent from high terrain. This is not a problem if operating in the FVR mode, but on those flights where FRL mode must be used, raising the airbrakes without applying the appropriate correction to FRL settings will exceed the 0.2 degree tolerance and cause the TA trace to be displayed erroneously low. We're able to use FVR most of the time where the angle of attack system automatically adjusts the radar antenna tilt and EVS sensor looking angle, so we develop habit patterns that ignore the FRL angle. Be cautious though. When making a rapid EVS-aided descent in FRL mode with the FRL misset due to airbrakes, the TA trace you're waiting for will level you off lower than planned (even though the EVS display is indicating properly).

TECHNIQUES

Coordination. When flying a fully integrated TA/EVS tactic coordination is more complicated. Use a philosophy of strict adherence to the TA trace and augment it with the EVS when the trace is less effective or not giving desired performance. The coordination between pilot, copilot and crew is critical to the success of the low level mission. A technique for keeping the crew notified of the display used was mentioned above, but what about the different range gates of the TA system. Do you make these changes yourself while you're in control of the aircraft? Unless you fly with your hand on the switch, or grope for it each time the Nav calls high terrain at 10 miles, it's probably distracting and could cause you to divert your attention from the TA trace for a sweep or two. Sweep-to-sweep trend information is as important and revealing to TA operations as a single profile display. So use it. Stay in the monitor for continuity and have the pilot not flying the aircraft make adjustments to the range gates, either automatically or on request. It shouldn't interfere with map reading or safety monitor responsibilities too much. Also both pilots will become involved in the TA/EVS tactic, rather than having one pilot and one map reader.

The EVS Descent. Any problems with the EVS-aided descent described in the TA/EVS videotape? It is an excellent method to fill the gap between high altitude dropout after peak crossing and the good tight low altitude trace back to the valley. It can even be used to accelerate your descent in a tactical threat situation. How would you handle the TA trace during the descent though? Chances are you might not get a usable trace until you're approximately 1200 feet AGL. If you see a "New York skyline" trace, verify that it's not a sheer cliff in front of you, state your intent and get on with the EVS descent. If the trace is usable, or when it becomes usable, transition to the trace and level off at TA altitude. As you descend and the trace improves, it may display lower than the HRL, especially if your EVS descent is shallow.

Have you seen the stan/eval writeup that says, "Fly down indications were disregarded and the terrain trace was consistently maintained well below the HRL for X-number of scans?" As a primary reference, once the trace is useable and below the HRL it must be followed to expedite the descent to TA altitude. The reverse situation is where your usable trace displays above the HRL. In this case you must verify that no excessively high terrain exists (use the EVS display, please) and either continue the EVS descent or pick up the trace for the remainder of the descent. Your tactical situation will dictate the urgency, but realize that it may be necessary to disregard the TA trace to descend rapidly. In this case the EVS display and radar altimeter must be monitored closely to insure terrain clearance.

High Terrain. The approach to high terrain is still an uncertain phase of the TA/EVS tactic for most pilots. The subject is covered in much detail in the TA/EVS videotape, but a plea to give the recommended techniques a chance to work for you is in order. Plan and study your low level mission well. Know what the maximum climb you'll have to make is, and compare this to your expected climb performance. This will identify potential problems areas. In flight, compare the rate of climb required to clear an obstacle to your maximum (predetermined) rate of climb from the performance manual. Then let this knowledge work for you by returning to TA altitude instead of arbitrarily starting a climb

at 10 miles if you still have a substantial performance margin.

Peak crossings for some time have left the aircraft exposed in an ascending flight path while waiting for radar altimeter drop out. The new paragraphs in the flight manual on EVS contour flight suggest that an alternative method is now allowed, but offers only sketchy guidance for performing it, so let's start during the TA ascent and take a look at one technique for an EVS crossover.

During a TA climb over high terrain, both the terrain trace and the EVS image of the peak will be roughly centered on the HRL. As the aircraft in a climb nears the crest, the obstacle will gradually move down and eventually pass out of view at the bottom of the monitor at a rate that varies with pitch attitude and range. It's this pitch that has caused the ballooning mentioned in the text, and in order to prevent it (and exposure) the aircraft pitch attitude at crossover must be reduced to near level flight, allowing a more rapid descent transition. The EVS display can be used so long as its limitations are recognized and caution is used. The text covers the necessary precautions, so let's look at the mechanics of the EVS crossover.

While you're making the TA ascent monitor the peak on the EVS, and when the peak image begins to move downward from the HRL, start a gradual pitch down keeping the peak just below the point where it becomes stationary (inpact point condition). This will create a flight path with a more level crossover, but if carried too far could result in an extremely low crossing or actual contact; so the object is to pitch down at some point so the peak's image passes from the impact point zone, through the near range video rush zone, and off the bottom of the monitor. The range at which this happens will determine the crossover value. Remember, though, that several variables working together will make crossover heights inconsistent.

The EVS sensor is designed to display approximately ±15 degrees vertically, but there are small differences in the vertical field of the STV and FLIR, so results in one mode will not be the same as the other. In FVR mode the sensor looking angle is controlled by the angle of attack system, and in FRL by the navigator's preset value. Any error due to internal malfunction, rapid pitch change, operator error, or airspeed control will induce uncertainty into expected crossover value. Lastly, the ability to plan on a crossover height depends on the reliability of a range-to-crossover estimate. If you are actually nearer than your range estimate when you let the peak move off the monitor, your crossing height will be lower than planned.

Here are some examples, based on the simple geometry of sensor looking angle, vertical display coverage and range. At a range of one mile, with the peak just going out of view at the bottom of the STV, a straight line flight path with no further pitch changes will result in a crossover of approximately 840 feet (wide field of view). At one-half mile, the figure is approximately halved to 420 feet. Remember, these figures assume perfect alignment and range estimates. If you're operating in FRL, the Nav must have the FRL angle set properly and the aircraft must be at the desired airspeed. Practice this technique with a qualified safety pilot to develop your skill at crossing obstacles with a minimum of exposure. All this happens very rapidly at close ranges, but continued practice and staying in the monitor should improve your proficiency.

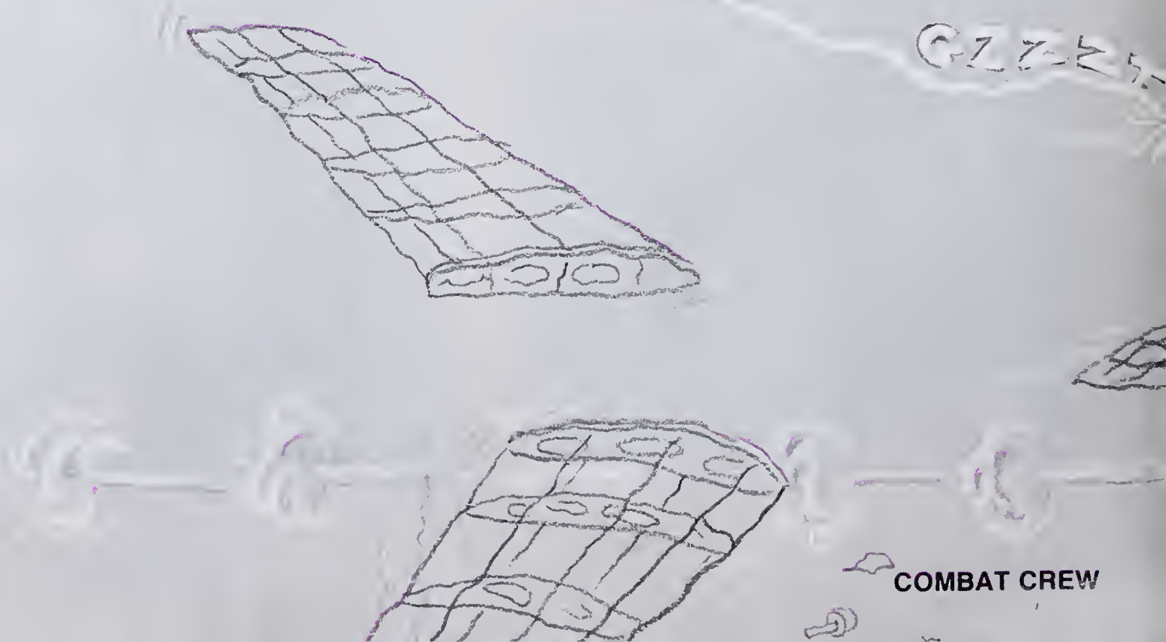
Once you achieve minimum exposure during the route you have increased your chances of getting to the target area. The second part of this article will cover techniques of TA/EVS bombing and look at flying night TA. This will appear in the July issue of Combat Crew.

WHEN LIGHTNING STRIKES

Editor's Note: Several recently reported lightning strikes to SAC aircraft prompts us to reprint this shortened version of an anonymous article which appeared in Combat Crew in May 1965. Last year, SAC experienced a Class A mishap when 25 feet of an aircraft wing separated after being struck by lightning. Since then, there have been several other reports of lightning damage to SAC aircraft.

In a majority of the reports, the crews had no radar indication of thunderstorms or they were flying clear of known buildups after being warned of weather problems. One area where lightning seems to be a hazard is the California flying area as the article depicts.

THE CREW of a KC-135 was on the last leg of a an uneventful ferry mission from Oklahoma to Travis Air Force Base, California. As they neared their destination, weather



was encountered, with moderate and occasional rain, and the aircraft was radar vectored to the Travis VOR for an ILS approach.

The weather appeared to offer no problem to the crew and they descended to an altitude of 2000 feet in preparation for the approach to base. Suddenly lightning struck and momentarily blinded all five crew members. As their vision returned they saw pieces of the radome flying up and over the aircraft.

The lightning hit at the 11 o'clock position on the nose of the radome. As the lightning-exploded radome departed the aircraft a light buffet began and the pilot's and copilot's IAS indicators fluctuated at different rates and the machmeter and true airspeed indicators went to zero while the altimeter remained stable. Inspection of the aircraft by the boom operator and crew chief revealed no visible damage other than on the radome, and a VFR position was maintained while Approach Control and the Command Post diverted a local F-102 to act as chase plane for the tanker.

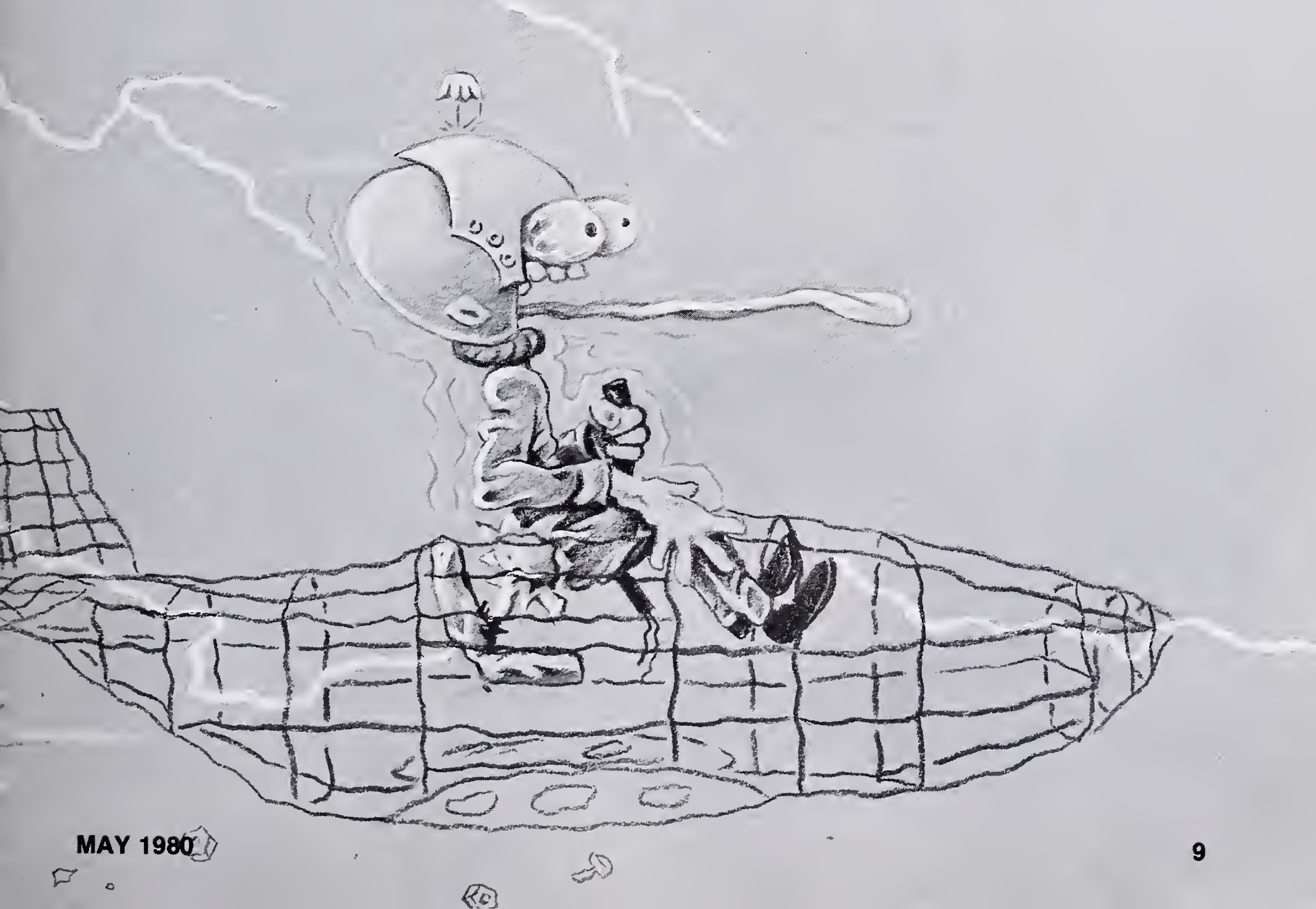
While awaiting the chase plane the pilot's and copilot's airspeeds differed as much as 70 knots and both command radios were very difficult to hear due to a high noise level. With the chase plane's arrival, however, it was confirmed that the pilot's airspeed indications were most accurate and would be relied upon while attempting a landing. Utilizing the chase plane, a successful approach and landing was made, and the crew brought the KC-135 to a halt without further difficulty.

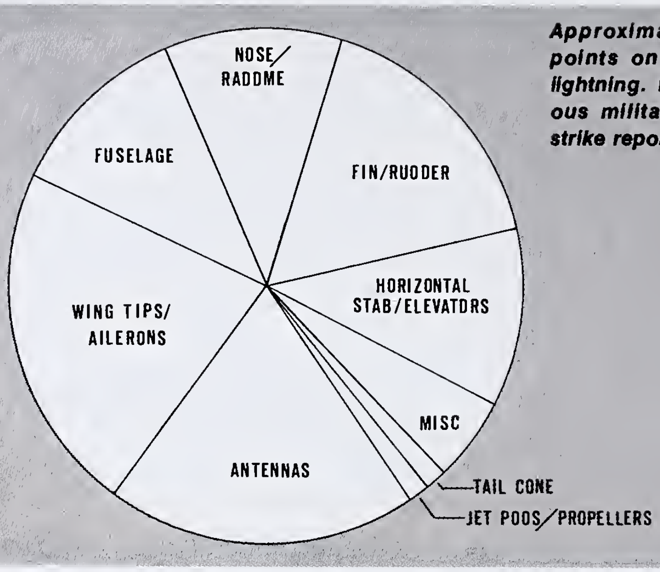
Inspection of the aircraft after the landing disclosed that, in addition to the damage to the radar unit, lightning energy had exited the left wingtip, burning a four square-inch hole in the outer trailing edge and popping five rivets on the bottom of the wing.

It has been generally considered that lightning constitutes a very low probability hazard to aircraft during flight, and while this crew was most fortunate in its encounter with lightning, the members would probably agree to disagree with such a view. They by no means would be the first or the last.

Most of the strokes, perhaps 90 percent, involve aircraft fuselage extremities for which adequate protection has been developed. The remaining 10 percent, however, can hit at such vulnerable spots as the fuel tank, where possible ignition of fuel could occur.

Laboratory studies with artificial lightning generators and scale-model aircraft show there is practically no aircraft surface area absolutely immune to a discharge. An aircraft intercepting a stroke may — as it continues its flight through the relatively stationary ionized air lightning channel — have repeated stroke current components of sufficient charge transfer to burn a hole in the thin tank skin of an aircraft. Aside from the more obvious hazards of direct stroke lightning, there are equally





Approximate distribution of points on aircraft struck by lightning. Estimated from various military and commercial strike reports.

serious problems with lightning-induced streamers; in fact, thunderstorm cross-field conditions can induce streamering near aircraft extremities without the aircraft actually being struck by lightning.

Experiments have demonstrated that whenever lightning discharges contact an aircraft, internal sparking may occur about discontinuities in the wing structure, such as around fuel caps, access doors or panels, fastening bolts or rivets, and high resistance joints. Any wiring entering the fuel tank such as fuel probe wiring may also produce arcing inside the tank if sufficient voltage is induced in the wiring. In one of these experiments, the right wingtip reserve tank of a KC-135 was used, and the effects which contributed to internal sparking were:

— Low and nonuniform conductivity resulted in sparking when the discontinuity was forced to conduct a high lightning current, as in the case of a direct strike contact to a fuel cap access door.

— Nonuniform conductivity, with conduction concentrated at a few points, resulted in sparking due to voltages developed across the discontinuity by currents flowing in the aircraft skin.

Two basic types of stroke contact were considered — the *wing strike* and the *direct strike*. For the wing strike, the stroke contact point was located at a point remote from the discontinuity being studied, usually at the tip of the wing or top of the mockup. In the case of the wing, the current was fed in at the contact point and out at the inboard mount. In the mockup, the current was fed in at the base and out at the top. This provided a sheet of current over the wing surfaces, including any discontinuities which could affect current path. For the direct strike, the contact point of the stroke was near the center of the cap, access door, or other discontinuities being checked, thereby forcing the current to flow through the boundary of the discontinuity. It was found that in flight the direct strike to a particular door or cap has a lower probability of occurring than the wing strike, but sparking is much more likely to occur in the case of direct stroke contact.

In the study of lightning hazards to aircraft fuel vents, the possible hazards considered included 1) the primary hazard of a direct strike into a fuel vent outlet with its tremendous ignition energies and possible spark showers, 2) the potential ignition hazard from streamers inducted by lightning strikes near but not at the vent, and 3) the effects of lightning discharge pressure waves in enhancing flame propagation in vents and through flame arresters. A series of tests utilizing very high energy discharges was made to evaluate these possible problems. The initial work on fuel vents was begun by setting up and providing high current, high energy discharges to the fuel vent system mockup for the study of flame propagation inside the vent line. The basic decision in this phase was to apply the high energy discharges directly to the vent outlet to supply the worst possible electrical environment. Thus, discharges with current crests of up to 200,000 amps were fired directly into and about the vent. Because of the low source voltage of the high current generator, the discharges were triggered with a 12-foot length of thin aluminum foil. The foil acted to increase somewhat the pressure magnitude, thus making the tests more severe but actually closer to realistic conditions.

Next, high voltage discharge

tests were made on the wingtip to determine the possiblity of direct strikes to the vent outlet. Potentials as high as 10 million volts were available, but lower voltages and closer spacings were found to give the maximum probability of strikes into the vent region. Streamering studies of the vent area were also made with potentials of about 10 million volts. The tests disclosed severe streamering from the wingtip but none from the vent scoop or vent outlet.

Under an earlier research program, shock waves from both natural and artificial lightning discharges were studied to determine if they might constitute a possible source for compression ignition of flammable vapors in aircraft fuel vents. These studies indicated that the shock from peak pressures and corresponding temperatures from a moderately severe lightning discharge current of 100,000 amps were not sufficient to produce direct compression ignition at distances of one foot or greater from the unrestricted lightning discharge channel.

From the studies highlighted in this article it can be assumed that there is a hazard to jet aircraft operating in or around thunderstorms due to the possiblity of ignition of flammable mixtures in the vent opening which could propagate through the vent system into the fuel tanks causing a catastrophic explosion. The probability of such an occurrence may be small, but with the size of the military and commercial jet fleet the likelihood of such an accident occurring within a given time span is increasing.

The studies also demonstrate that when lightning strikes an aircraft several effects can result: damage will be slight and injury to crews quite rare, in the majority of cases. If airplanes were perfect, uninterrupted metal shells, with no insulated conductors such as antennas leading into fuselage, it is quite probable that a dangerous current would never be transmitted internally. The intense field created by a lightning strike, however, can be quite troublesome to flight crews and maintenance personnel. Ferrous metals may become magnetized and indicators which utilize magnets may be disorientated by local steel parts. Magnetic compasses are most vulnerable in this respect; and after a strike has occurred, compass readings are suspect and should be cross-checked by whatever means are available before trusting them for navigation. All ferrous metal components in magnetically critical areas should be ground-checked after a lightning strike, for it is usually necessary to demagnetize them.

Unfortunately, as mentioned earlier, aircraft are not and cannot be perfect metal shells. The extremities, which most often serve as electrodes for the strike, are commonly fitted with nonmetallic radomes, and antennas of various kinds project beyond the shield of the metal shell. Flight control surfaces also offer projections which are vulnerable because of their shape, location and attachments to the shell. As would be expected, these are the components most often damaged by lightning strikes.

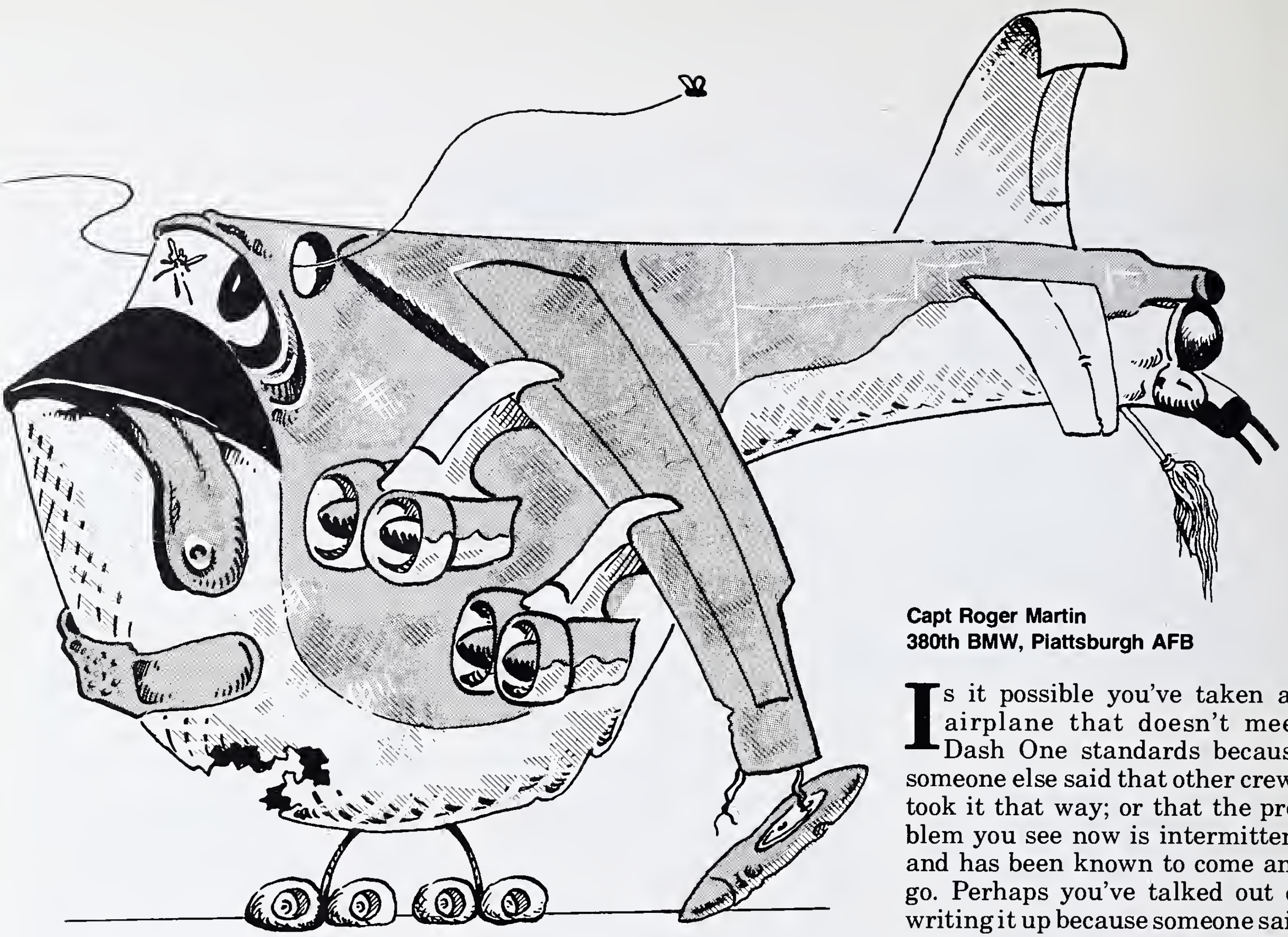
Non-conductive shells — such as radomes — present thorny design problems, and in view of the high incidence of lightning strikes they warrant some particular attention. Their susceptibility to lightning damage stems principally from their location and their non-conducting qualities. Although radomes are primarily shields for the antennas, their streamlining is also an important factor to the aircraft's flight characteristics, and when hit by lightning the debris can be carried by the slipstream to cause damage to other sections of the aircraft.

Antennas are often instrumental in leading lightning into the cabin where it damages equipment and exposes personnel to danger. For this reason, lightning arrestors have been developed; but these arrestors are not intended to provide protection for the external antenna. They are designed to carry off the destructive voltage rather than to allow the lightning to hit the fuselage.

Control surfaces, such as rudders and elevators, are prime lightning targets because of their location and are easily damaged since they are hinged and constructed of light-gage material. There is no practical way to preclude all current transfer through hinge bearings, but it can be reduced to a certain extent by providing bonding jumpers between the fixed and the movable structure. This provides paths of low resistance and a large portion of the current can be bridged safely. However, when millions of volts are applied, current will inevitably flow through the bearings. Therefore the bearings must be inspected if a flight control surface is struck by lightning.

It is obvious from these studies, and the recent KC-135 incident that a number of hazards to aircraft and crew exist whenever you fly in the vicinity of lightning or thunderstorms.

The knowledge of and a healthy respect for the potential danger of this inflight hazard can prevent you from being another lightning strike victim.



Capt Roger Martin
380th BMW, Plattsburgh AFB

Is it possible you've taken an airplane that doesn't meet Dash One standards because someone else said that other crews took it that way; or that the problem you see now is intermittent and has been known to come and go. Perhaps you've talked out of writing it up because someone said maintenance tech data is different. Or, maybe you've taken a

---

The SMO Seminar

2Lt Wayne S. Sprong
Site Maintenance Officer
90th OMMS, F. E. Warren AFB

What's a SMO, much less a SMO seminar?

A SMO is a site maintenance officer. They are responsible for the hardware of all launch and launch control facilities in the missile wing. They supervise selected in-field maintenance and certain on-base major maintenance to insure quality maintenance is performed; i.e., technical, safety, and security compliance.

SMO's were born from a test program initiated at Malmstrom AFB. Capt Robert J. Southard, OIC Management Support Division authored the test program under the direction of Col Walter H. Casey, vice wing commander. SAC then adopted the program at the other missile wings in October 1979.

In November 1979, Col C. H. Greenley, 90th SMW commander, opened a SMO seminar and extended a Cheyenne welcome to all attendees. Col Edwin S. Usui, deputy commander for maintenance, chaired the meet of the entire Minuteman missile fleet for a two-day crosstalk seminar. He stressed the importance of human communications/interaction in order to keep the SMO program alive and well. He unconditionally and enthusiastically supports the new program, as he strongly encouraged 100% support from the entire maintenance complex.

Representatives at the meet from each missile wing and Chanute TTC were: Capt William

All right, who owns that airplane?

plane you normally wouldn't because you really needed that sortie.

We're not talking about a radio that won't channelize to a preset frequency but works in manual selection, or an air refueling system that won't work when you plan only a pattern ride; what we are talking about here is the sort of thing that's basic to flight safety — an engine that exceeds operating limitations, an ADI OFF flag that won't go away, etc. etc.

Aircrew members, especially you who are command pilots, have distinct authority and responsiblity. The nature of your commission allows you a degree of authority. Your experience implies authority. AFR 60-1 requires you as flying personnel to be responsible for, "The safe and effective use of flying esources made available to you." AFR 60-16 states that, "A signature by the pilot in command on the flight plan is evidence of approval and signifies that . . . "the individual is aware of the responsibility for the safety of the aircraft or formation of aircraft and its occupants." And that, folks, is a tremendous responsibility. No crew chief, no standards different from those with which you are to comply, can relieve you of the responsiblity.

It is very important that aircrews understand the standards. Here is an excerpt from the FB-111 Dash One: "In some cases, the limits and tolerances presented in the flight manual are not precisely identical to those presented in the system maintenance manuals. The numerical values in the flight manual are to be used as operating guides by aircrews." I emphasize "flight manual." What makes this binding is an earlier statement in the Dash One: "Clearance must be obtained before any questionable operation not specifically permitted in this manual is attempted."

To go a step beyond, AFR 60-7 directs aircrews to, "Comply with the instructions and follow the procedures in the appropriate flight manual and its authorized supplements during aircraft operations." Finally, lest there be any doubt, T.O. 00-5-1 states that, "Compliance with Air Force T.O.'s is mandatory."

The issue is clear. If there is any doubt in your mind that an aircraft you are to fly does not meet Dash One requirements, make certain that doubt is satisfied before you fly. If something is out of tolerance, write it up. It is not only your opportunity to get a safe product by regulation, it is your obligation.

A. Allen, Minot AFB; Capt Joseph E. Snook and MSgt Calvin N. Winn, Grand Forks AFB: Capt Johnny D. Patterson, Ellsworth AFB; Capt William Weller, Whiteman AFB; Capt Norland C. Hoeffer and 1Lt Richard A. Carter, Malmstrom AFB; Capt Robert L. Moore, Chanute AFB; and SMO seminar project officer 2Lt Lawrence L. Linzmeier, F. E. Warren AFB.

Capt Stephen Garcia, CINCSMO, led the seminar in discussing SMO utilization, staff agency interaction, SMO responsiblities, wing similarities, test program, flight ownership, dispatch documentation, SMO training; the unique SMO experience was thoroughly discussed during the two-day seminar. The new requirements of SACR 66-12 establishing the SMO branch were discussed and directions for a successful program were fully detailed. A wealth of information was shared and absorbed by all the seminar participants. New horizons were discovered which will allow the SMO program to be a positive new asset to the missile maintenance complex.

The SMO program is over one year old at Malmstrom, but the other missile wings had until January 1980 to get up to speed with the program. This was a monumental task and the bottom line on why there was a SMO seminar.

SMO Seminar members: November 1979.

BIG
INSTRUMENT

WIND SHEAR
- PART 3

Increasing Headwind
Decreasing Headwind

Tome H. Walters, Jr.
1st Combat Evaluation Group
Barksdale AFB, Louisiana

Part Two in our wind shear series dealt with the aircraft's reaction to a wind shear. In this part, we'll look at the two shear cases — increasing headwind and decreasing headwind — from start to finish. We'll begin each case by reviewing how the aircraft performs when it crosses the shear. Then we'll talk about the pilot's reaction. Finally, we'll look at the performance requirements when the aircraft is reestablished on the glide path.

INCREASING HEADWIND

Aircraft Reaction – When an aircraft flies through a shear where the headwind component increases, this is what happens:

- Indicated airspeed increases by the amount of the shear value.
- Lift increases, causing the aircraft to pitch up and go above the glide path.

Pilot Reaction – The pilot sees an increase in airspeed and the aircraft going high on the glide path. The ingrained pilot response is to reduce power and nose over to return to the glide path. When the aircraft returns to the glide path, what happens next? Is the situation solved, or is there more to come? The answer is, there's more to come.

New Performance Requirements – When you power back and nose over to get back on the glide path, your work's not over. In fact, it's just started. What you do next is even more important. Here's why.

An aircraft has a certain amount of inertia built up as it moves through the air. The easiest way to explain the inertia is to say that ground speed is the aircraft's inertial speed. When the headwind component increases, the indicated airspeed increases almost instantaneously. That's what the pilot sees and reacts to. But the ground speed does not instantaneously change. The stronger headwind overcomes the aircraft's inertia — i.e., reduces the ground speed — more slowly.

Once that happens, the performance requirements are different. Look at figure 1. The aircraft begins the approach in a tailwind where the initial power requirement is less than normal. Let's say we have a thrust scale of 1 - 10 and the normal no-wind power setting is 6. Because of the tailwind at the start, the pilot has the power set at 5. When the aircraft crosses the shear and goes hot and high, the pilot reduces the power to 4. When the aircraft gets back to the glide path, in this example, it's in a different wind environment. The change (increase) in the headwind component now requires the normal power setting of 6. So the pilot now needs to make a second power change which will be *larger* than the first correction. That is the key point to remember. The pilot must add more power than he/she pulled off to restabilize on the glide slope.

Long or Short Landing? – Wind shear articles often speculate on whether the shear will cause you to land long or short. The fact is, either type of shear — increasing or decreasing headwind — can cause you to land either long or short. The controlling factor is the altitude of the shear above the ground. The Director of Flying Operations for Northwest Orient Airlines, Captain J. T. Fredrickson, published a wind shear article with some excellent examples. We'll include all six examples here. They make the problem very clear.

The first three examples (figures 1 thru 3) are the increasing headwind shear. When you look at the examples, you might ask how do they get increasing headwind when it shows a tailwind on top and zero wind at the surface. Good question. Remember that we've emphasized over and over that there are only two shear cases — increasing or decreasing headwind. All we're doing is defining the shear problem in terms of one variable — the headwind component. In this case, we'll consider the tailwind as a negative headwind at the marker going to zero wind at the runway. The headwind component is increasing. If that confuses you, we'll try to explain it another way using the indicated/ground speed comparison.

Assume your indicated airspeed is 140 knots. If the surface wind is zero, then your planned ground speed over the threshold would also be 140 knots. If the tailwind at start descent was 20 knots, then your ground speed at that point would be 160 knots. You would compare your ground speed initially to your "reference" ground speed over the threshold to see what the wind was doing. In this case, you would start at 160 knots and end at 140 knots. That would tell you the headwind component increases 20 knots during the approach.

We'll cover the indicated/ground speed comparison at length in part four. We only use it here to clarify how you determine whether you're facing an increasing or decreasing headwind situation.

One final comment about an increasing headwind — aircraft performance *increases* in an increasing headwind. What do we mean by that? Simply that indicated airspeed and lift increase. Increasing headwind means increasing performance. It's all gravy. We won't say any more, here. But we'll have quite a bit to say when we get to a decreasing performance situation.

DECREASING HEADWIND

Aircraft Reaction – When an aircraft flies through a decreasing headwind shear, this is what happens:

- Indicated airspeed decreases by the amount of the shear value.
- Lift decreases, causing the aircraft to pitch down and go below the glide slope.

Pilot Reaction – The pilot reacts to the drop in airspeed and the aircraft going below the glide path by pulling back on the yoke and adding power. If the shear does not require more performance than the aircraft has available, it will get back on the glide path (hopefully). Then what?

Continued on Page 30

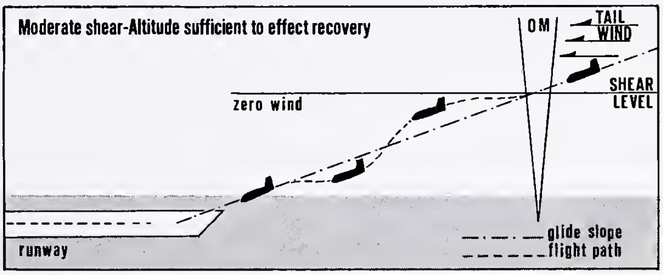


FIGURE 1
- Increase in airspeed is equivalent to the shear value
- Lift increases, aircraft pitches up and rises above the glide path
- Pilot reduces thrust to reduce speed, noses over to return to glide path
- The need is now for *more* thrust than required when flying in the tailwind condition
- Probably over-corrects, airplane descends below glide slope, speed increases beyond target value, but recovery is made and landing is successfully completed.

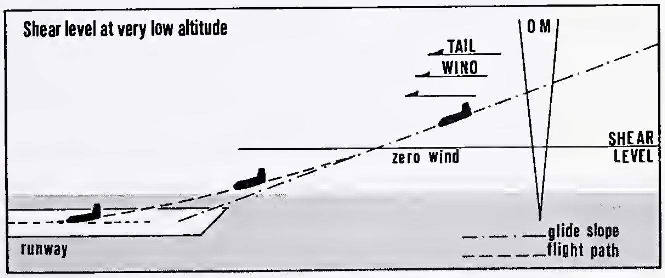


FIGURE 2
- Increase in airspeed is equivalent to the shear value
- Lift increases, aircraft pitches up and rises above the glide slope
- Greater speed and height above normal flight path result in a fast, long landing.

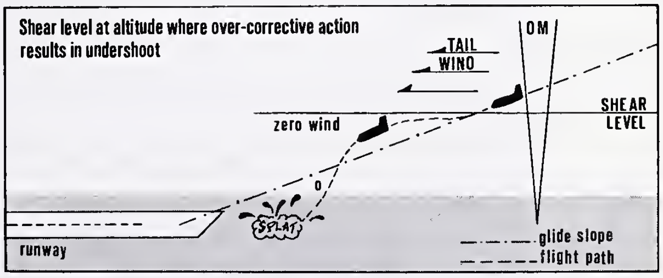
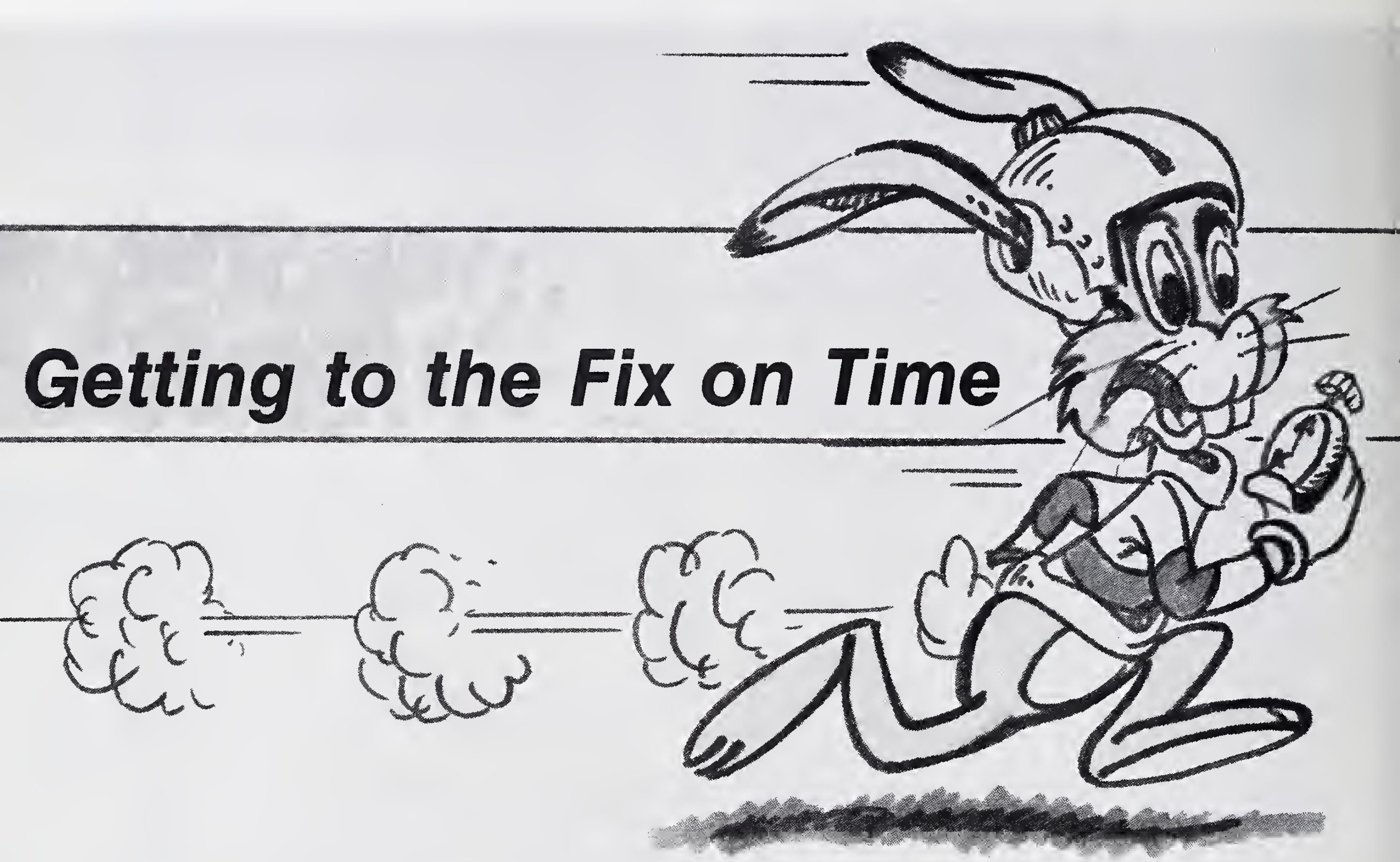

Shear level at altitude where over-corrective action results in undershoot
O M
TAIL
WINO
SHEAR
LEVEL
zero wind
SPLAT
runway
glide slope
flight path

FIGURE 3
- Increase in airspeed equivalent to shear value
- Lift increases, aircraft pitches up and rises above glide slope
- Pilot reduces thrust to reduce speed to target value, noses over to return to glide slope. Nose-down trim is likely to be used
- Airplane decelerates in response to thrust reduction, target airspeed is regained, requirement is now for *more* thrust than needed in the earlier tailwind portion of the approach
- Aircraft is in a high drag configuration, engine spool-up requires time, instantaneous thrust is not available. Descent below glide slope occurs at critically low altitude, nose is pulled up sharply, increased angle of attack produces only a slight or momemtary increase in lift accompanied by a tremendous increase in drag as the maximum values of the lift/drag ratio are exceeded. The result is a momentary arrest of the descent with rapidly decreasing airspeed, followed by a large increase in an already high descent rate
- Pilot's only hope is to pull on the yoke and push on the throttles
- Pilot action is too late; aircraft impacts short of the runway.



Getting to the Fix on Time

Capt Paul T. Shorock
HQ AFMPC, Randolph AFB

Pilots' ability to make good control times may have become a casualty of crew coordination. Most navigators control time so well, pilots may tend to be lax. When called upon to perform some time control, they must dust off some rusty skills learned at an earlier point: At a low level entry, given a 2.5 minute tolerance, I've seen pilots use the bulk of the tolerance and look to the IP seat for approval because they managed to enter legally (just barely. They happened to be lucky. Time control doesn't have to be a casualty. Getting to a desired point at a specified time is a skill; if not fully understood it must be practiced or it will atrophy. On our normal missions it's good sense to eyeball checkpoints along the route, monitor low level entries, and make good EAC's for penetration. If some portion of the mission falls through the crack, make it a time to practice holding skills. Stay out of trouble, ask for a delay — but practice holding. With enough practice you won't have to sweat holding in any situation — CEVG and checkrides included. If the pilot can reliably make the entry, the navs can fix a radar set that just went tango uniform (totally unusable).

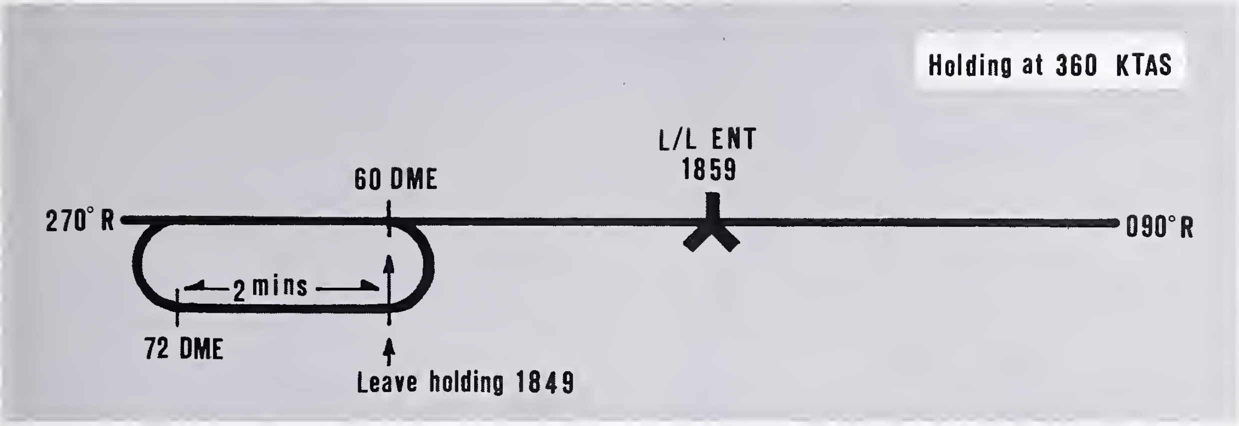
Here's a review of low level entries aimed mainly at bomber crews — but anyone can use it as a basis to refine their holding skills:

First, you need to know the time you want to cross the low level entry fix.

Second, request clearance to hold. Center wants to know where (radial, DME and the length of legs), when you want to leave (EAC), and how you plan to continue the mission. We have all heard pilots garbage up the radios by stating they have a problem and want center's help, but they don't state their intentions, and it usually becomes a game of twenty questions. Center just doesn't have the time. If you haven't requested holding often, precan as much of the information as you can during mission planning. This way you can avoid asking for holding in restricted airspace or be closer to your METRO station or STR site. You might not get the clearance you had planned on, so have a backup. By stating your intentions, you generally hold where you want to, as opposed to where the center wants you to hold.

Third, get the clearance. Roger — IS NOT A CLEARANCE. ATC clears . . . is.

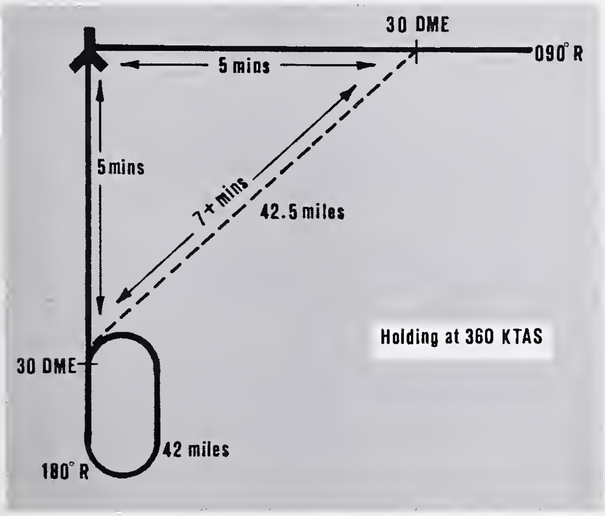
Finally, fly your clearance.



Now, a little logic about picking a holding pattern. For entries over a Tacan, use the reciprocal of the penetration radial assuming it's in conflict free airspace. Make it easy on yourself — pick the fix 60 miles from the station (30 as a minimum) and use legs that will be two minutes long. You might as well precan the holding airspeed, since it's probably **not** going to be 230 KIAS. Figuring the airspeed enables you to determine the leg lengths you desire.

You might be wondering how these numbers make it easier. In a no wind situation, 60 miles to the station can be covered in 10 minutes at 360 KTAS. Subtracting 10 minutes from the time you desire to cross the entry fix, you arrive at your EAC to depart holding. The two minute legs give you an 8 minute holding pattern. Nothing magical about eight minutes, but knowing the time per pattern sure is helpful.

Besides being easy to work with, the numbers provide some safety valves. In the unlikely event you miss the EAC, you can speed up or slow down almost two minutes, since 240 KTAS to 480 KTAS are usually within our parameters. Holding away from the station is a good idea because you won't have to worry as much about people entering the route, through your airspace.



I like to make the scheduled low level entry time on the early side, by about 30 seconds. If I'm too early, I still can do a 360 with center's approval. Watch out for Roger, again.

The 360 is an often forgotten option. Missing the scheduled entry by three minutes, some crews rule out the 360. Probably in the heat of battle they lock onto the scheduled time as an absolute and forget about the two and one half minutes on the backside.

If the entry point is not at the station, use a fix perpendicular to the entry fix. Timing logic requires only slight modification. You don't need to get as far away from the station to give yourself a pad. Plan to cover the entire distance from holding via the station to the entry fix. But have the time direct from holding to entry in your hip pocket. By playing the time to turn direct to the entry point you're in complete control.

It must be noted some nav teams don't like to be driving away from the entry point because they can't see it or they might not be confident in your holding and time control abilities. With practice, you can get proficient (within 15 seconds) and really give them an assist.

Slant range and the effects of wind have not been covered. You can almost ignore the slant range, while windage could be the basis for another entire article.

With these techniques you have the basis to monitor all entries where you have reliable TACAN information. With good crew planning, you can be on time every time.

***Editor's note:** Capt Shorock was previously assigned to the 320 BMW B-52 Stan/Eval Division and to the 42 BMW as a B-52 IPU prior to his present assignment.*

CFIC Corner

Landing with the Green Side Up

Capt Hugh E. Smith,
Central Flight Instructor Course
Castle Air Force Base, California

As you stroll confidently through the halls of your squadron one morning, you are approached by one of your hot young AC's. "Hey," he exclaims, "My copilot has been having a little trouble with his landings lately. I can't understand why because he's had one every 45 days for the last six months. Since you're one of the high time Buff pilots around here, wonder if you could have a little chat with him, maybe even go fly with?"

You think to yourself, "This is my opportunity to do some real instructing instead of going to SCT-1, comm class or other similarly mundane activities". But what will you say? How will you approach teaching the landing without the aid of an aircraft and runway to help? It's a question we've all asked ourselves before. Landing the aircraft is an easy maneuver to demonstrate but one that's quite a bit tougher to talk about. Let's take a look.

Every Buff pilot should, and probably does, have a pretty good handle on how to land the airplane. But some of us may have a little trouble organizing our thoughts on procedures and techniques in order to effectively share our ideas with other less experienced pilots. What follows may provide some food for thought for telling someone how to land the B-52.

Landing the B-52 is not inherently difficult, but it is different than landing most aircraft, and considerably different than landing the trainers used in ATC today. In our discussion let's consider some of the pitch, power, and speed relationships involved, look at the visual cues we use, and discuss the primary action points during the landing phase.

The major difference between landing a B-52 and most other aircraft is due to the location of the landing gear. The more conventional tricycle landing gear allows a much larger range of airspeeds and pitch attitudes during the landing phase than does the twin tandem gear. If you are in level flight at an airspeed above simultaneuous touch down speed (see figure 1) the forward gear is lower than the aft gear. We all know the most common result of touching nose gear first! Conversely, if we attempt to hold the aircraft off too long, we will touch down below minimum touchdown speed resulting in a hard landing.

The difference between simultaneous touchdown speed and minimum touchdown speed is the "speed range" or "window" that we aim at to touchdown. With the twin tandem gear, this "window" is relatively small. The old saw of adding a few knots for mom, and a few more for the kids just doesn't work in the BUFF. The B-52 will not land HOT! Since minimum touchdown speed is strictly a function of gross weight, and simultaneous touchdown speed varies with airbrake position, the pilot may change the size of this landing "window".

The selection of airbrake position four as the normal landing configuration is due primarily to a larger airspeed/pitch window, control ability, and more constant lift during lateral inputs. The airspeed "window" decreases with airbrake position to the point that at airbrake zero the difference between simultaneous touchdown and minimum touchdown speeds may be only one or two knots. (See Figure 2) If you check the *Instrument Accuracy* chart in the performance book you quickly see that the airspeed indicators are not that accurate. Think about this the next time you consider an airbrakes zero approach. The dash 1 says you should land at minimum touchdown speed, aft trucks first. Beware of landing attitudes for simultaneous

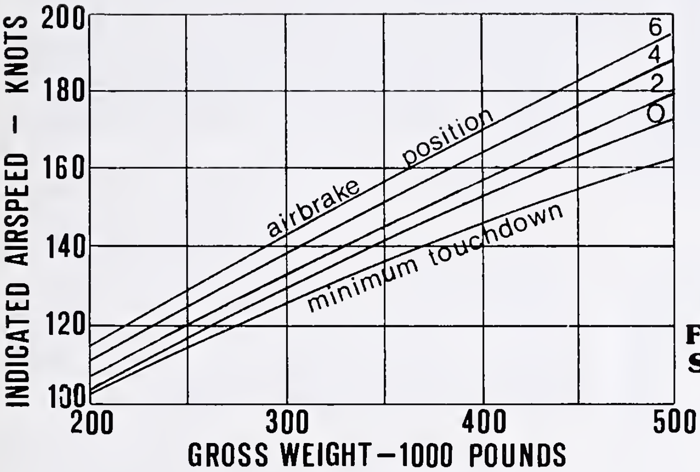


FIGURE 1 —
SIMULTANEOUS TOUCHDOWN SPEED

touchdown (the grease job) . . . one knot above simultaneous touchdown, one degree nose low from simultaneous touchdown, and you have to dig out your nose gear recovery techniques.

We all know that a good landing usually begins with a good approach, and a not so good landing is often the result of a not so good approach. So let's discuss some visual cues for line up and glide path. When lining up for landing emphasize rudder and very small bank angles. You can tell when you are lined up properly by the way the runway looks. If you are left of centerline, the left side of the runway appears to go straight away rather than converging toward the center at the horizon. The angle between the end of the overrun and the left edge of the runway appears greater than the same angle on the right side. The converse is true if you are lined up to the right. (See Figure 4)

For glide path go ahead and use all available aids, VASI lights, ILS glide slope, etc, but be aware of how the runway looks. A very flat looking runway usually indicates a flat dragged-in approach. A very tall, skinny looking runway usually indicates a steep approach. (See Figure 5). Watch out for landing illusions here! For example, if you are used to landing on a 300′ runway and shoot an approach to a 200′ runway, you will feel higher than you really are. One visual technique often used to help line up the glide path is the imaginary tunnel. No matter where you visually pick up the runway or where you roll out on visual final, you attempt to enter an imaginary tunnel (See Figure 6). Some pilots use an imaginary gate. The principle is the same. You must get your man to approach the runway exactly the same way *everytime, on* glide path, *on* centerline. He will never be able to land the airplane consistently well if he never approaches the runway the same way twice. If he does the same thing every time, he will be able to learn when to reduce power and when to begin his flare.

Now, Let's consider some action points during the short final portion of the approach. (See Figure 3) Action point one is that point at which the pilot begins to include the runway into his crosscheck. Even the most inexperienced copilot can generally get you to this point. If he can't, his problem is more than just landings, and he

FIGURE 2 — SIMULTANEOUS TOUCHDOWN VS MINIMUM TOUCHDOWN AT VARIOUS AIRBRAKE POSITIONS

AIRBRAKES	BEST FLARE	SIMULTANEOUS T.D.	MIN T.D.
6	136	129	115
4	130	126	115
2	124	120	115
0	119	117	115
GROSS WT 250			

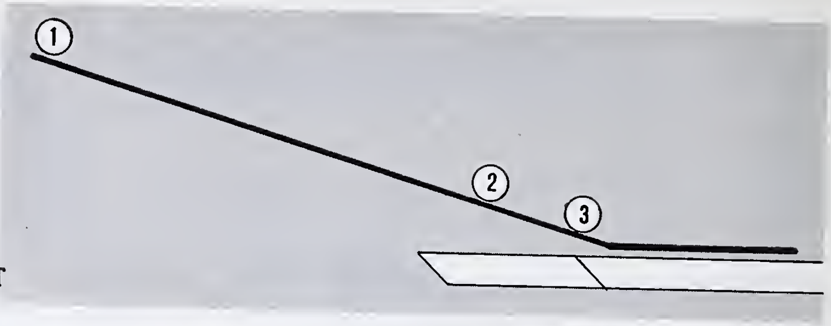


FIGURE 3 — SHORT FINAL ACTIONS START

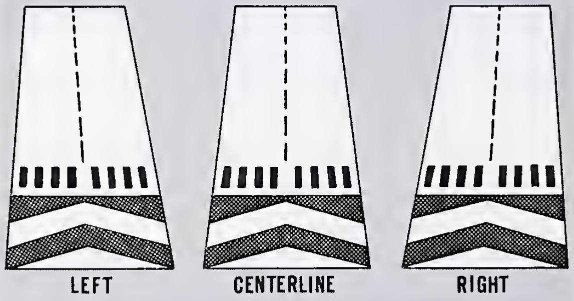


FIGURE 4 — LINE UP

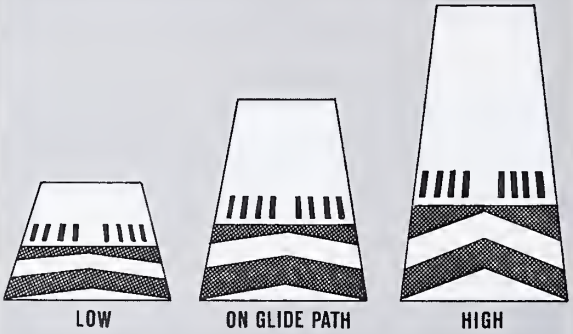


FIGURE 5 — GLIDE PATH

will need more indepth work in instruments and other areas. The landing problem begins because we are often not content to leave well enough alone. The tendencies are to either lower the nose or to raise it. In fact the best thing to do at this point, if we are on course, glide path, and airspeed is "don't change anything".

Consider what happens to the inexperienced pilot when he ducks under. As he lowers the nose, the first thing that happens is an increase in airspeed (remember there is a pitch attitude for each airspeed). The pilot then attempts to correct the airspeed by retarding power. This doesn't appreciably change airspeed, but rather increases rate of descent. When the power is retarded, glide path and rate of descent become very noticable, and due to the same misconception of power and pitch, the pilot pulls the nose up to correct. When this occurs angle of attack and, therefore, induced drag increase markedly, and would you believe it, the airspeed falls off. If the pilot pulls the nose up initially at action point one, the same thing occurs only one cycle later. At any rate improper pitch and power control on short final may result in an approach that resembles something akin to a roller coaster ride.

Action point two comes as you cross the end of the overrun (or approximately 1000′ from the runway threshold). The pilot must do three things at this point: 1) hold the glide path with elevator, 2) start slowly retarding the power,

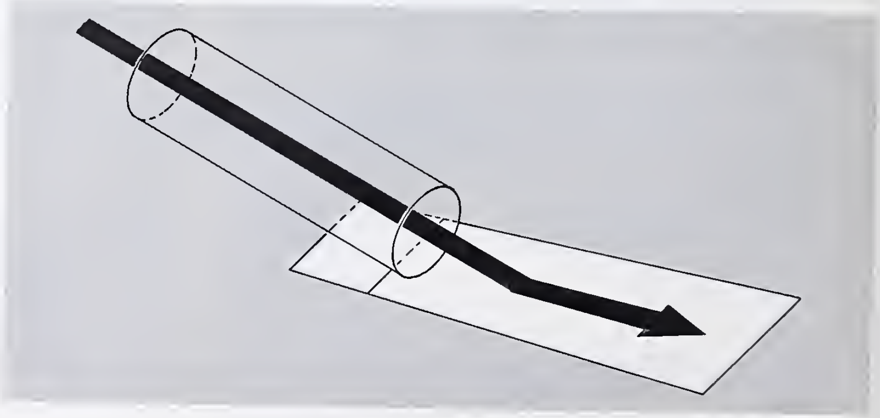


FIGURE 6 — THE IMAGINARY TUNNEL

and 3) TRIM. Holding the glide path with elevator is often easier said than done. All you really have to do is maintain your aim point. This is not unlike maintaining an impact point on an EVS aided descent. Your aim point can be described as that portion of the picture in the windscreen which is not moving. Note where your aim point is super-imposed on the windscreen. This will help identify landing attitude later.

In conjunction with maintaining aimpoint, you begin to slowly retard the throttles. The faster you retard the throttles the more dynamic the forces on your aircraft become. Why make it tough on youself? *Slowly* retard the power and trim, this point cannot be overemphasized . . . TRIM. Three forces are trying to pitch the nose down between crossing the overrun and beginning the flare. Airspeed is slowing from best flare plus 10 to best flare. The underslung engines produce a pitch-down force when power is reduced. This force is called pendulum effect. Entering ground effect also causes the nose to want to pitch down. It should also be noted that as airspeed decreases the elevator is becoming less effective. The total of these forces results in a requirement for approximately two units of trim.

At action point three the cheese gets a little more binding. This is where you begin the flare. You have lost 10 knots and are now at best flare speed, you have trimmed the aircraft to compensate for the power reduction and airspeed loss, but when do you flare? It is difficult to tell someone when to flare. We've all heard a number of statements about when to flare, none of them sound real *neat*. "Hold the glide path until you can't stand it anymore" . . . "when the runway begins to show texture" . . . "when you cross the threshold". PLEASE! The truth may be that "when to flare" just doesn't lend itself to classroom discussion. Some say this is the point at which landing is no longer a science but rather an art. The best learning here may have to come from demonstration and practice. You will probably have to show your pilot when to flare. What is the flare anyway? The flare is merely assuming the landing attitude. Your eyes must switch from the aim point to the horizon in order to do this. If you hold this attitude with the power at idle, the airplane will touch nicely.

Can we be more specific about what the landing attitude is? Well yes, there are a number of visual clues to describe the landing attitude. During preflight . . . "Ya see where the horizon is? Landing attitude is a little nose up from that!" Trouble is, it may be several hours before you get back to the pattern and seat position will change this perspective. Up on downwind, level flight . . . "Ya see where the horizon is? Landing attitude is a little nose up from that." Neither of these techniques are very precise. You may have to demonstrate a landing or establish landing attitude and hold level flight with power down the runway.

This is the best way to show someone that landing attitude is a little abstract, and requires the airplane to track the aim point on short final. But it is certainly real and is probably what you are really doing even if you don't realize it. Note where the aim point is superimposed on the windscreen. If you are tracking directly to it, that means you are flying the aircraft straight to the aim point. When the time comes to flare, you raise the nose to place that point on the windscreen on the horizon. You are now flying the aircraft straight to the horizon.

Well, now you high time Buff pilots may be a little more confident about "talking landings". Next time some young pilot asks you how to land you can say, "I can handle that".

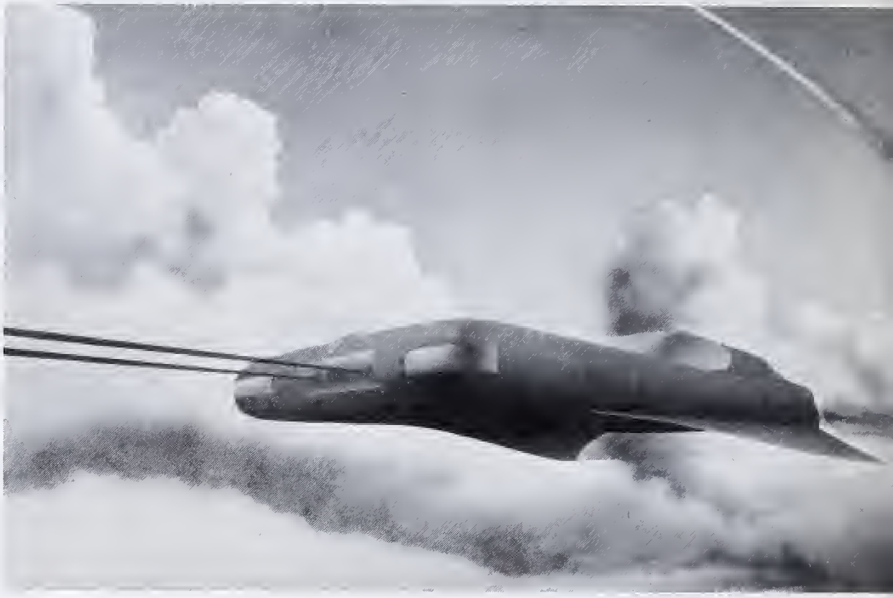
* * *

"You don't have to be in this profession very long before one quickly understands that if your instructor cadre is not the premium of performers, then your sharp edge on your flying/fighting force erodes quickly."

That, explained Maj Gen Andrew Pringle, Jr., SAC/DO, during the dedication of the CFIC building in January, is why Castle has and will play an important role in the history of the Strategic Air Command and the Air Force. To put it more simply, "How goes Castle, goes the command."

Maj Gen Andrew Pringle, Jr, unveils the new Central Flight Instructor Course sign. The unveiling took place during recent dedication ceremonies for the newly renovated CFIC building at Castle.

R&D Corner



"Phasers, Lasers and Blazers"

Maj G. R. Hepfner,
HQ SAC/XPHN

Bong! Bong! Bong! The alarm blasted in everyone's ears. "Zingons," cried the watchmaster, "50 light rods away and approaching rapidly from star quadron 34.17."

The captain calmly viewed the early warning scope, verifying the number and approach of the enemy ships. Relief coursed through his veins as he saw that the attacking force consisted of only 25 attack fighters.

"No sweat," he thought to himself as he maneuvered his own craft into firing position, "although this is one of the oldest 'Superbuffs' in existence, its recent trip through the PDM line at star fleet depot included the installation of updated phasers and lasers, and the newly developed, super deadly blazer."

Fantasy, science fiction, yes the above passage is that. "Phasers" and "Blazers" may well be the weapons of the far future. And while lasers are playing ever-growing roles in today's weapon systems, their development as a pure "stand-on-its-own" weapon has yet to be realized.

We are not, however, standing still in weapons development. In truth, weapons development is, and has been, a very major part of our R&D effort. As a result, like the old "Superbuff" in the above fictional passage, our own aging B-52 is being outfitted with new weapons and will still be a potent force many years in the future.

Probably the best known new weapon being developed for the B-52 is the Air-Launched Cruise Missile, or ALCM. With a low radar cross-section, and flying low to the ground, it is being designed to fly over 1000 nautical miles, penetrate the enemy's defenses and hit the target with a very high degree of accuracy. Scheduled for an Initial Operational Capability, IOC, in late 1982, ALCM's long legs and high accuracy will give our B-52G force the capability to strike a large number of enemy targets while standing off a considerable distance from his homeland.

The ALCM, while it will eventually give us a standoff force, is not the only new weapon on the horizon for our strategic bomber force. Under development is a new gravity weapon which offers new capability for penetrating bombers. This weapon, combined with planned improvements to our current stockpile and to aircraft weapon controls, will give B-52s and FB-111s increased flexibility in both targeting and tactics. In addition, these weapons are being designed not only to be compatible with any penetrating bomber which might be built in the near future, but also to take advantage of any new capabilities that a new bomber might have.

Improved safety and security features are also being incorporated into strategic weapons. Permissive Action Link (PAL) provides for enhanced command and control and, once incorporated into all of our weapons, will replace the on-aircraft coded switch system. In addition, a new Insensitive High Explosive (IHE) has been developed which makes weapons much less susceptible to shock or heat and better able to survive the environmental extremes of an aircraft or tow vehicle accident.

R&D efforts have not been solely directed toward strategic weapons. In the conventional weapon arena, "smart bomb" is the by-line for today and the future. The days of flying over the target and dropping tons of iron (general purpose bombs) over the target are rapidly disappearing. This change is for many reasons, but probably the most important of which are the increasing sophistication of enemy defenses, and that while iron bombs can be used against many targets, they are not completely effective against most.

The sophistication of enemy defenses is a multifaceted problem. Not only are defenses becoming more and more deadly to the attacking aircraft, they are also becoming effective against the weapons launched by the aircraft. To counter defenses, the Air Force is devoting a great deal of effort toward developing weapons with a standoff capability. Such weapons will provide the capability to remain outside an enemy's defenses and attack with pinpoint accuracy. Once launched, the weapon will avoid defenses by maneuver, low altitude or speed, and attack the target either directly or by dispensing submunitions. This standoff concept includes such weapons as the Guided Bomb Unit (GBU) family (many of which are already in the inventory), HARPOON (a Navy-developed weapon with an anti-ship capability), HARM (a joint Air Force/Navy developmental anti-SAM site/radar weapon), and conceptional weapons such as MRSM (Medium Range Standoff Missile).

During the Vietnam era, it was discovered that there were serious deficiencies in effective weaponry. To assure destruction, either several attacks or massive amounts of bombs were required in a single attack. Either case required a large amount of aircraft and weapons to do the job. This experience has spurred the effort to develop weapons with more and more effectiveness. This effort can be broken down into two major areas of development; the first being weapons which are extremely accurate and the second devoted toward weapons with a multiple-kill capability.

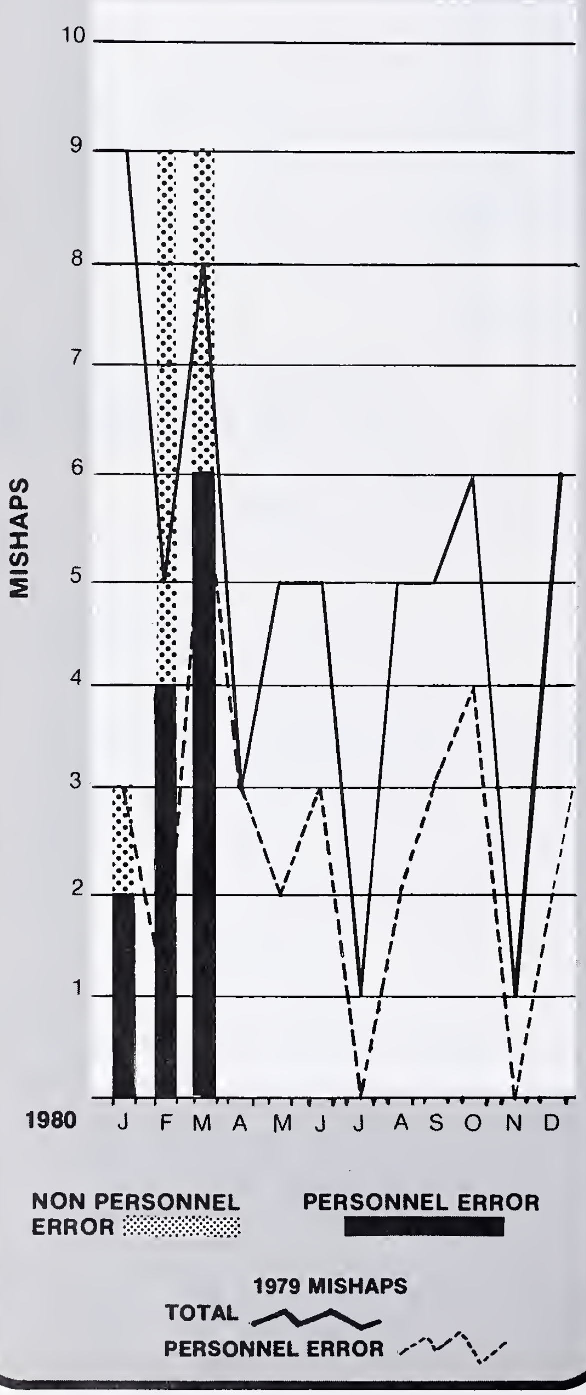
Probably the simplest and least expensive means of improving accuracy has been the laser. A laser system consists of a designating unit, which directs a laser beam on a target, and a weapon kit which includes a sensor to recognize and home in on the designated point of the laser beam. This system works well but is weather and daylight limited. TV-guided weapons have also been developed which provide even more accuracy than laser-guided weapons. Imaging Infrared seekers are being developed for a wide variety of guided weapons and represent an enhanced capability at night or in weather over the TV- and laser-guided weapons. For the long range standoff weapons of the future, we are looking at combinations of midcourse and terminal guidance features. These combinations will guide the weapon to the general target area and then home in on the target itself.

A multiple-kill capability is one that's been worked for a long time. Currently in the inventory is a variety of Cluster Bomb Units (CBUs) which consist of a dispenser and submunitions. Some are designed as antipersonnel weapons, some are antimaterial, and a few are antiarmor weapons. The dispensers, when dropped, open at a preset altitude and disperse the submunitions over a wide area, hopefully hitting many of the targets in the area. Unfortnunately, these are not always as effective as we would like them to be, especially against armor. New families of submunitions and dispensers are in various stages of development and should soon provide a very good capability against a wide range of targets — including armor. The weapons development community is taking action to incorporate these new submunitions in future standoff weapons, thus providing a standoff, multikill capability not currently available.

The new weapons described above will give our aging aircraft a new punch both in the nuclear and conventional arenas. The goal in the SAC R&D world is to assess these new weapons in relationship to their use on our aircraft. Once we've determined that they will in fact add to the aircraft's capability, every action necessary will be taken to incorporate them into SAC's inventory as rapidly as possible.

Missile Mishap Report

DOD CLASS A, B and C



A RUSTY SRAM

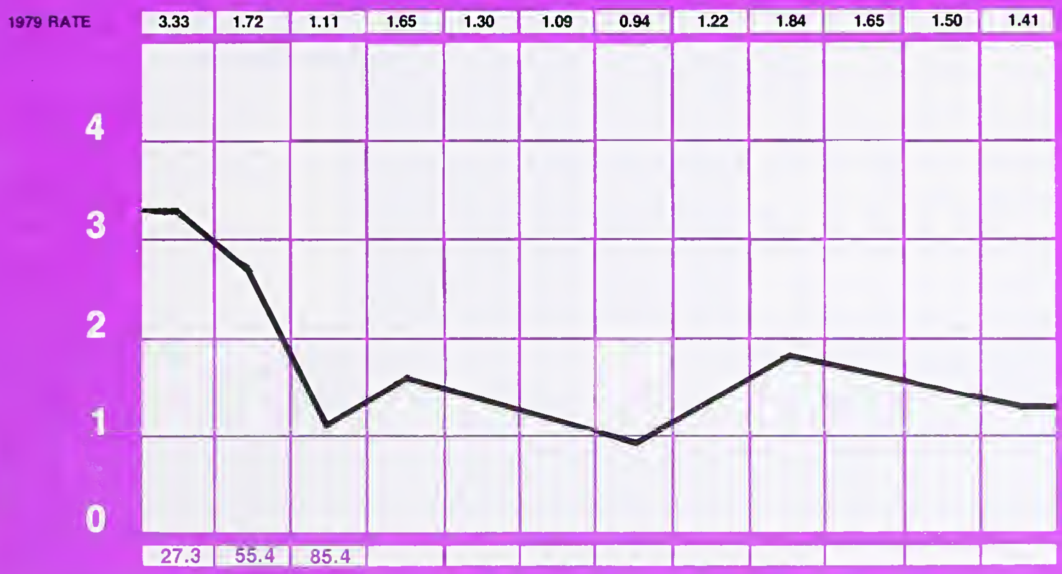
An AGM-69A missile was being prepared for loading and the flight control actuator assembly (FCAA) water accumulation test was performed. At this time, 20 millimeters of water was introduced into the measuring cylinder. Upon removal of the FCAA, corrosion was discovered in the hydraulic pump and motor, all three hydraulic servo valves, main casting assembly and the J21 mount. A gas bottle actuator squib and accumulator investigation revealed an improper seal between the fin platforms which allowed excessive moisture to accumulate in the FCAA. Closer attention should be given when installing the fairing and during the required four month inspection to insure fin platforms are properly sealed to prevent moisture from entering the FCAA.

JUST A LITTLE SHOWER

Launch duct and engine sprays activated at a missile complex dumping approximately 60,000 gallons of water in the launch duct. A faulty connection in the electrical junction box on the outside of the launch duct wall for the fire sensor on level four activated the sprays. Efforts to turn off the launch duct and engine sprays were initially unsuccessful. Fire water pump P-1 was deactivated after setting circuit breaker 8 in LS-3 to OFF. At this time, launch duct and engine sprays were also deactivated. A "SUM Check Fault" lighted abnormally when the butterfly valve lock control circuit breaker was set to ON. BVL electronics module was determined defective at this point and was replaced. The BVL cover allowed moisture contamination of electronic module. Determination of cause is under investigation.

1980 Flying Safety Rate

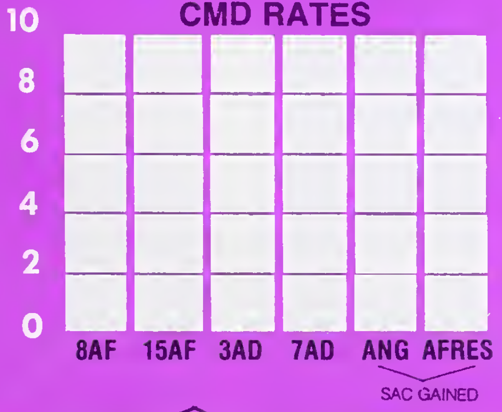
SAC CLASS A MISHAP RATE (PER 100,000 FLYING HRS)



CUMULATIVE FLYING TIME (1,000 HRS)

MISHAPS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1979	1	0	0	1	0	0	0	1	2	0	0	0
1980	0	0	0	0								

1980 SUBORDINATE CMD RATES



MISHAP STATUS

LEGEND = 1979 RATE (SAC)
+ = ANG
* = AFRES

TO SAVE A LIFE=

MED-EVAC

Capt Onesimo Solis, Jr.
42 AREFS, Loring AFB

The air is tense as crews and maintenance personnel work hard to insure that our cell will take off together. It's the ORI season and while we are trying to filter out the alphabet soup on the radios, a single radio call quiets things for a second. "Loring Ground, Med-evac 503 standing by to start engines." No, this is not a ploy to impress the IG, but a flight to save a life.

Loring's location in the North Country prompted the development of a system to handle medical emergencies. The Med-evac system was instituted here to provide a quick way to transport critically injured patients to specialty hospitals when the time factor is prohibitive of ambulance or MAC C-9 Med-evac transportation. The KC-135 Stratotanker is then called upon to perform this mission of mercy.

A Med-evac flight is a total wing effort with operations, maintenance and the hospital collaborating to insure the success of the mission. Tanker crewmembers know that a call in the middle of the night might mean that another life-saving effort is required.

Take for example the scenario alluded to in the first paragraph. The wing is gearing up to fly the ORI. Maintenance is working on two aircraft in an attempt to launch them at a later time. The third cell is starting engines. While all this going on the command post gets a call. A child sustained a serious head injury and the doctor recommends that he be rushed to a hospital in Bangor, Maine. Since an ambulance trip may take up to four hours, the hospital commander requests a Med-evac flight from the wing commander. A tanker whose mate has been scrubbed is selected to take the child to Bangor. One hour and 20 minutes after the hospital commander asks for the flight, the crew takes off between the third and fourth cells.

Fortunately, an aircraft was ready. Occasionally, maintenance is afforded the luxury of having an unscheduled airframe that it can put on standby status. However, many Med-evac birds come from aircraft in the pattern that meet the fuel requirements or more often from one that just happens to be available. Whatever the case, when job control is notified that an airplane is needed, every available crew chief is called in to get the bird ready.

Some of the places that tankers have flown into include Bangor International, Logan International in Boston, Andrews AFB, Wright-Patterson AFB and La Guardia in New York. The command post has on file mission packages containing routes of flight to all these locations. When directed to prepare for a Med-evac the first command post call is to job control asking for an aircraft. Then they call base operations with the flight plans and call base weather for an enroute weather briefing. The next call is to the transportation management office to insure that any equipment necessary to put the patient on board is available and at the aircraft. The squadron commander is notified that a crew is needed and crewmembers are called in to prepare for flight. The alert facility is called to provide crews to accomplish the preflight, takeoff data and Form F computations. By the time the aircrew reaches the aircraft, it is in a ready to start engines configuration and the flight plan is filed. From the time wing commander is notified to the time the aircraft is airborne about two hours have elapsed.

Loring crews have flown many Med-evacs over the past few years and will continue to provide this service with the same intense professionalism as always. The personal satisfaction experienced in saving precious lives is great and Loring crews wear their Med-evac patches proudly.

To Save A Life — "Med-Evac 503, Cleared for Takeoff!"

CTB

INSURANCE POLICY FOR QUALITY MAINTENANCE

Sgt Vickie J. Rice
381SMW, McConnell AFB

The Centralized Training branch was conceived to improve the quality of our technicians and their maintenance. The CTB concept was designed to train individuals who have completed formal technical school and upgrade them to an equivalent of 5-skill level proficiency before dispatching them to a missile complex as a member of a qualified team.

During the first 30 days after their arrival on base, the airmen complete initial requirements such as obtaining security clearances, insure placement on personnel reliability program (PRP), and attend a driver's training course. They also enroll in an initial training program which includes missile safety, nuclear safety, maintenance standardization evaluation program (MSEP), maintenance data collection (MDC) and technical data training. After completing standard in-processing and initial in-processing, each individual has the basic qualifications to dispatch to a missile complex for further training.

Depending on their AFSC's, the individuals will be temporarily assigned to the CTB for a period ranging from approximately 120-180 days. Here they acquire the skills necessary for 5-skill level proficiency.

The instructors are formed into a mobile training team composed of highly skilled technicians of various AFSC's in the Titan II missile system. Before being placed on the training team, each instructor completes an instructor training course, an OJT trainer orientation course, and a supervisor's course.

With the advent of CTB, classes will be standaradized using equipment trainers, visual aids, and video tape recordings. Under the guidance of highly qualifed instructors, the students will be dispatched to missile complexes to perform maintenance. It is expected that this first-hand experience will enhance the ability of technicians.

Because of the knowledge gained during indepth training and instincts instilled by experienced instructors, our trainees, McConnell AFB, the Titan II system and the Air Force will profit from CTB — The Insurance Policy for Quality Maintenance.

PROFESSIONAL PERFORMERS

FLYING CREW

An outstanding job of coping with a serious landing gear malfunction, merits the selection of B-52G Crew E-19, 97th BMW, Blytheville AFB, as SAC Flying Crew of the Month. After takeoff on a night training mission, the crew attempted to retract the landing gear. The two forward main gear, however, failed to retract. Seconds later, the right forward gear retracted but the left forward gear remained down and rotated to a full 20 degrees of left crosswind crab (gear turned to the right). The crew aborted the mission, returned to a holding pattern over Blytheville and contacted their command post and maintenance specialists for assistance.

Top, Crew E-19, 97 Bomb Wing, (L-R): Capt David A. Ochsner, 1Lt Robert D. Perry, 1Lt Robert T. Kadechka, A1C Stephen S. Wingate. Bottom, (L-R): 1Lt Doyle K. Freeman, Maj Leonard A. Netzer, Jr., Capt David A. Brown, Jr.

During the course of performing in-flight emergency procedures and malfunction analysis, the remaining landing gear were lowered and they also drove to the full 20 degrees position. Repeated attempts to clear the malfunction and center the gear failed. After determining that a landing on a normal runway was neither practical nor safe, the decision was made to fly to Edwards AFB, where a landing on Rogers dry lake bed offered more suitable conditions.

The radar navigator and navigator devised a flight plan, computed flying time enroute, and prepared for the aerial refueling rendezous. The electronic warfare officer kept communications lines open and passed vital information and status to home station, while the defensive aerial gunner assisted in crew coordination and checklist procedures. Drag from the extended landing gear not only necessitated fuel onloads totaling 180,000 pounds, but also caused the aircraft to be very power limited during the aerial refueling. However, by refueling at a much lower altitude, the crew was able to transfer enough fuel from a Blytheville KC-135 to reach a second tanker aircraft from Carswell AFB and then proceed to Edwards AFB.

On arrival at Edwards, the crew made preparations to execute a landing on a natural landing surface which provided less than optimum visual reference. Consultation with experienced representatives from SAC, 8AF, Boeing, and Edwards provided analysis of aircraft performance and a suggested configuration and landing technique. The pilots made several approaches to the dry lake bed to evaluate depth perception problems. The navigators repositioned themselves to their crash landing stations on the upper deck while the pilots set themselves up for the final approach and landing.

As the aircraft touched down on the misaligned gear, it jerked abruptly to the right and began rapidly tracking off the runway centerline. Since unlimited space was available on the dry lake bed, the aircraft commander used minimum braking and steered the aircraft only as necessary to keep the wings level and maintain control. The aircraft came to a final stop approximately three and a half miles from the touchdown point and roughly 300 yards right of the depicted centerline. The landing marked the conclusion of an unprecedented effort in coordination and airmanship which resulted in the safe recovery of an invaluable SAC strategic aircraft and crew. The men of Crew E-19 can certainly be counted among SAC's top professional performers.

MAINTENANCE NCO

SSgt Barry D. Moody, 305 AMS, Grissom AFB, is SAC Maintenance NCO of the Month. Sgt Moody's superior technical knowledge and managerial abilities combined with his professionalism and dedication to duty are reflected in the success the squadron has had in deployment exercises and inspections. In his current position as NCOIC of the AMS Analysis Section, the squadron is provided with excellent analysis support due in the most part to the pride he takes in his job. He is an outstanding noncommissioned officer and a valuable asset to SAC and the United States Air Force.

TITAN CREW

Crew S-093, 381st SMW, designated as Titan Crew of the Month includes: MCCC Capt Walter J. Randall, Jr., DMCCC 2Lt Michael E. Welham, MSAT SrA Brian V. Grace, and MFT SrA John R. Wadella.

This crew is a highly professional and dedicated SAC Missile Combat Crew. Their expertise, military bearing and knowledge of the Titan II weapon system serves as an outstanding example for the remainder of the wing. As the senior crew at the squadron command post site, they have done a superb job in insuring that that site was properly maintained and remained fully mission capable. They persistently refused to be stymied by obstacles and aggressively performed their duties under the most trying circumstances. While these crewmembers have been together for only two months, they consistently achieved excellent results on monthly EWO and weapon system training examinations.

MINUTEMAN CREW

Capt Wayne H. Hill and 2Lt Anthony Goins, Crew E-094, 351st SMW, are named Minuteman Crew of the Month based on their sustained superior performance as crewmembers and their exemplary efforts in several additional duty areas. Initially paired together on 1 Feb 80, they also assumed their first alert as a crew on this date. Within minutes after signing for the alert, the crew received an environmental control system alarm. This was the first indication of what eventually resulted in a requirement to operate the launch control center on the emergency air conditioning unit in excess of 16 consecutive hours. Accurate emergency actions and professional judgment by Crew E-094 prevented what could have resulted in a major fire and a serious degradation of command capability of vital nuclear resources.

BIG INSTRUMENT

Continued from Page 15

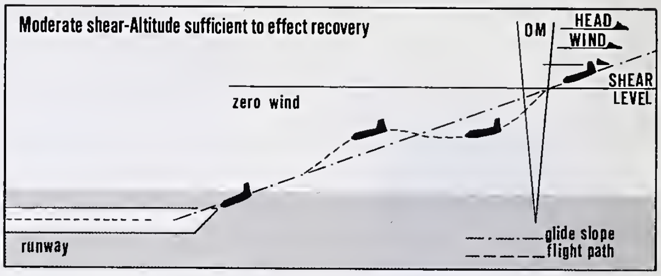


FIGURE 4
- Loss of indicated airspeed is equivalent to shear value
- Lift is lost, aircraft pitches down, drops below glide slope
- Pilot applies power to regain speed, pulls the nose up and climbs back to the glide slope
- Probably overshoots the glide slope and target airspeed but recovers and lands without difficulty.

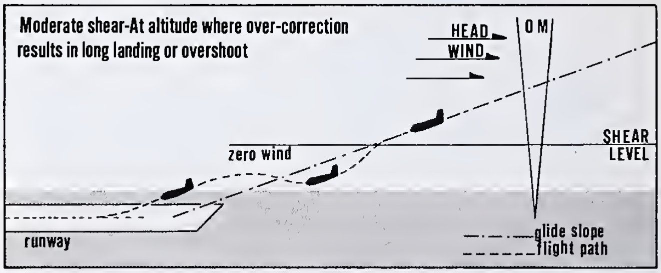

Moderate shear-At altitude where over-correction results in long landing or overshoot
HEAD
WIND
OM
SHEAR
LEVEL
zero wind
runway
glide slope
flight path

FIGURE 5
- Loss of indicated airspeed is equivalent to shear value
- Lift is lost, aircraft pitches down, drops below glide slope
- Pilot applies the power to regain speed, pulls the nose up to climb back to the glide slope. Nose-up trim may have been used
- When airspeed is regained, thrust required is less than required for the previously existing headwind
- Thrust is not reduced as quickly as required, nose-up trim compounds problem, airplane is climbed back above glide slope
- Airplane lands long and fast.

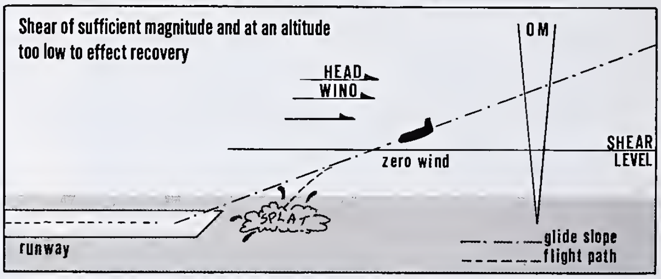

Shear of sufficient magnitude and at an altitude too low to effect recovery
OM
HEAD
WIND
SHEAR
LEVEL
zero wind
SPLAT
runway
glide slope
flight path

FIGURE 6
- Loss of airspeed is equivalent to shear value
- Lift is lost, aircraft pitches down, drops below glide slope
- Pilot applies the power to regain airspeed, pulls nose up to climb back to glide slope, engine spool-up requires time
- Aircraft is in high drag configuration, altitude critical, increase in angle of attack produces only a slight or momentary increase in lift accompanied by a tremendous increase in drag as the maximum value of the lift/drag ratio is exceeded. The result is a momentary arrest of the descent with decreasing airspeed followed by a large increase in an already high descent rate.
- Pilot's only hope is to pull on the yoke and push the throttles
- Pilot action is too late, aircraft crashes short of the runway.

New Performance Requirements – Let's use our thrust scale of 1 - 10 again. If 6 is the normal no-wind power setting, then the strong headwind above the shear (figure 4) would have required a higher than normal power setting at start descent. We'll say the thrust was initially set at 7. When the aircraft went low and slow, the pilot added power. Let's say he/she added one unit and got back on speed and on glide path with power set at 8. By now, you can see that changes will have to happen.

In the zero wind situation, the pilot must pull off more power than was initially added. That is the key point, again. The second correction must be *larger* than the first one or the aircraft will over-correct. Wind shear is a two act play! You have to make one correction to get back on glide path, then make a second, larger correction to stay there.

Long or Short Landing? – A decreasing headwind shear can cause you to land long or short. It all depends on the altitude you encounter it. Look at figures 4 thru 6. Each example tells its own story.

Decreasing Performance – Decreasing headwind means decreasing performance: the airspeed drops and the aircraft goes below the glide path. If you have the feeling that this situation is the more dangerous of the two, you're correct. However, there is a solution to the problem. We'll talk about this problem and its solution in next month's article.

NEXT MONTH

In our final article, we'll explain how to use the indicated/ground speed comparison to evaluate an approach for wind shear. We'll explain why wind shear is an energy management problem. We'll be very specific and recommend parameters and techniques you can use.

SAC SAFETY SCREEN

305 AREFW, Grissom Crew R-113: P Capt William F. Evans, Jr, CP Capt Michael G. Scheller, N Capt Michael R. McCarty, BO A1C Kevin E. Gearliart

380 BMW, Plattsburgh Crew E-58: P Capt John J. Blewitt, Jr, RN Capt James O. Spear

380 BMW, Plattsburgh Crew E-161: P Capt Wesley E. Kauder, Jr, CP Capt David S. Duncan, N Capt William A. Ady, BO Amn David Pye

379 BMW, Wurtsmith Crew R-11: P Capt Joel R. Caudle, CP 1Lt Kenneth Hovatter, RN Capt Peterson N. Higgins, EW Maj Charles R. Bruer, G A1C Gary A. Plain

340 AREFG, Altus Crew E-124: P Capt Robert H. Byzewski, CP Lt Sy M. Mendenhall, N Capt Charles H. Vessey, B SSgt Christopher Sadler

2 BMW, Barksdale Crew R-107: P Capt Kent M. Ramey, CP Capt Larry T. Johnson, N Capt Ronald A. Seyle, BO SSgt Michael V. Harrison

380 BMW, Plattsburgh Crew E-131: P Capt Thomas Butler, CP Capt Larry O'Keefe, N Capt Willis Sexton, BO TSgt William King

305 AREFW, Grissom Crew E-149: P Capt Francis C. Goelz, CP Capt Bill E. Betka, N Capt Samuel J. Bolen, BO SSgt Alvin R. Moser

55 SRW, Offutt Crew E-11: P Capt Ronald J. Allen, CP Capt David Proper, N-1 Capt Charles Pitts, N-2 Capt Anthony Bivona

6 SW, Eielson Crew S-01: IP Capt Lawrence E. Ford, CP Capt Ronald E. Bullard, IN Capt Jon W. Anderson, NN 1Lt Edward T. Marino

6 SW, Eielson Crew E-15: TC Capt Philip M. Wright, ATS Capt Russell G. Wendt, ATS Capt Larry A. Mayfield, ATS 1Lt Aubrey G. Lawson II, R4 1Lt Wayne L. Stafford, MT 1Lt Howard G. Cohen, PT Sgt Robert B. O'Borne, ET SSgt Dennis J. Grundhauser

22 BMW, March Crew R-131: P Capt Jim Bean, CP Lt Tom Yerke, N Lt Mike Paulson, BO A1C Larry Scotto

384 AREFW, McConnell Crew E-157: P Maj Marlin J. Schaeffer, CP 1Lt David A. Hornung, N Capt Monty S. Hoffsommer, BO SSft Kenneth W. Schmelzic

384 AREFW, McConnell Crew R-107: P Capt James J. Garrity, CP Capt Ryan S. Dow, N 1Lt Donald G. Jones, BO Sgt Danny R. Gilson

97 BMW, Blytheville Crew E-26: P Capt Robert A. Youngquist, CP 1Lt David G. Van Orsow, RN Capt Robert E. Cunningham, NN 1Lt David J. Grenda, Jr, EW Capt Floyd J. Battazzo, AG Amn Larry A. Stewart

44 SMW, Ellsworth Crew E-150: MCCC Capt Diether H. Van Houten, DMCCC 2Lt David E. Fulk

308 SMW, Little Rock Crew R-008: MCCC 1Lt Frederick V. Williams, DMCCC 2Lt Oatice M. Thomas, MSAT SSgt Nelson J. Wellspeak, MFT Amn Gordon Fleming

341 SMW, Malmstrom Crew R-026: MCCC 1Lt Robert H. Krause, DMCCC 2Lt Timothy R. Antozzi

390 SMW, Davis-Monthan Crew E-190: MCCC 1Lt Richard E. Holley, Jr, DMCCC 2Lt Leo Giles, MSAT A1C Keith Yonamine, MFT Amn Mark Christ

The SAC Safety Screen is an honor roll of SAC's most professional crews. To gain listing on the Screen, crew members must be nominated by their unit commanders and meet high selection criteria of experience in their aircraft or missile system *IAW AFR 127-2/SS1.*

*U.S. Government Printing Office
1980—665—145/3

UNIVERSITY OF FLORIDA
3 1262 09304 9772

FLARE

HALL OF FAME

TACTICAL FLYING

OVER TWENTY-FOUR YEARS	
170 AREFG, McGuire (NJANG)	None
OVER TWENTY-TWO YEARS	
171 AREFW, Greater Pittsburgh (PAANG)	Mar '58
OVER TWENTY-ONE YEARS	
157 AREFG, Pease (NHANG)	June '58
97 BMW, Blytheville	Aug '58
OVER TWENTY YEARS	
940 AREFG, Mather (USAFR)	May '59
307 AREFG, Travis	Sep '59
OVER NINETEEN YEARS	
151 AREFG, Salt Lake City (UTANG)	Feb '61
161 AREFG, Sky Harbor (AZANG)	Apr '61
126 AREFW, Chicago O'Hare (ILANG)	Apr '61
OVER EIGHTEEN YEARS	
134 AREFG, McGhee Tyson (TNANG)	Aug '61
11 SG, Fairford	Feb '62
OVER SEVENTEEN YEARS	
340 AREFG, Altus	Jun '62
96 BMW, Dyess	Aug '62
OVER SIXTEEN YEARS	
19 BMW, Robins	Aug '63
OVER FIFTEEN YEARS	
160 AREFG, Rickenbacker (OHANG)	Dec '64
OVER FOURTEEN YEARS	
320 BMW, Mather	Jul '65
OVER THIRTEEN YEARS	
452 AREFW, March (USAFR)	Sep '66
92 BMW, Fairchild	Feb '67
OVER TWELVE YEARS	
55 SRW, Offutt	Jul '67
2 BMW, Barksdale	Aug '67
OVER ELEVEN YEARS	
5 BMW, Minot	Feb '69
OVER TEN YEARS	
42 BMW, Loring	Sep '69
141 AREFW, Fairchild (WAANG)	Oct '69
OVER NINE YEARS	
28 BMW, Ellsworth	May '70
OVER EIGHT YEARS	
7 BMW, Carswell	Mar '72
101 AREFW, Bangor (MEANG)	Mar '72
306 SW, Mildenhall	Apr '72
OVER SEVEN YEARS	
416 BMW, Griffiss	May '72
305 AREFW, Grissom	Aug '72
379 BMW, Wurtsmith	Apr '73
OVER SIX YEARS	
931 AREFG, Grissom (USAFR)	Feb '74
384 AREFW, McConnell	Mar '74
OVER FIVE YEARS	
189 AREFG, Little Rock (ARANG)	May '74
43 SW, Andersen	Dec '74
OVER FOUR YEARS	
68 BMW, Seymour Johnson	Sep '75
6 SW, Eielson	Dec '75

ICBM

OVER FIFTEEN YEARS	
1 STRAD, Vandenberg	Sep '64
OVER FOURTEEN YEARS	
308 SMW, Little Rock	Aug '65
OVER TEN YEARS	
341 SMW, Malmstrom	Apr '70
OVER SIX YEARS	
390 SMW, Davis-Monthan	Jul '73
OVER FIVE YEARS	
351 SMW, Whiteman	Oct '74
91 SMW, Minot	Nov '74
OVER FOUR YEARS	
321 SMW, Grand Forks	Feb '76

To gain listing in the Hall of Fame, a SAC or ARF unit must be Class A mishap-free for 48 months.